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THE VALUE OF AMMONIA DETERMINATIONS ON PERITONEAL FLUID IN THE DIFFERENTIAL DIAGNOSIS OF PATHOLOGIC STATES RESULTING IN HEMORRHAGIC ASCITES*

PRELIMINARY REPORT

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Ammonia in the animal body derives from many sources. Oxidative and hydrolytic enzymes in liver, kidney, muscle, brain, heart and blood enter into reactions capable of liberating free ammonia.² There is no doubt, however, that the bulk of ammonia formation in the body occurs in the gastrointestinal tract by putrefactive processes involving the fecal flora, and by the action of intestinal urease, which is bacterial in origin. Damodaran and Narayanon⁴ in 1938 demonstrated that the liberation of ammonia by proteolytic activity was too small to account for the relatively vast amounts entering the portal system. It is also well known that the level of ammonia in venous tributaries to the portal vein is highest in the cecal region and decreases as the duodenum is approached. The experimental work of Terraine and Lauresco⁹ suggests that the longer dietary protein is retained in the gastrointestinal tract (under the influence of the normal intestinal flora) the greater is the conversion of amino-nitrogen into ammonia. Blood entering the liver through the portal vein is cleared of most of its ammonia content by urea synthesis in a single passage of portal blood through the liver.

An acute block to the venous drainage in one of the portal radicals results in venous strangulation of the small bowel and the accumulation of

hemorrhagic fluid within the peritoneal cavity. Anderson and Tanturi¹ have shown that hyaluronidase is present in significant quantities in strangulated obstructed loops and emphasize the importance of this enzyme in increasing the permeability of the bowel wall. Nemir and associates⁷ have called attention to certain chemical and spectrophotometric changes in the intraluminal contents of strangulated bowel; these same chemical and spectrophotometric changes were later demonstrated in the peritoneal fluid indicating that transudation of certain intraluminal material could occur through the wall of strangulated obstructed small bowel. The very origin of this fluid would suggest that the ammonia content should be elevated, and if so, the determination of same in such transudates might be useful in the differential diagnosis of certain pathologic conditions resulting in hemorrhagic ascites. The following experiments were designed to test this hypothesis.

EXPERIMENTAL PROCEDURE

Healthy adult mongrel dogs were used for all experiments. During operative procedures all animals were anesthetized with intravenous Nembutal and strict aseptic techniques were observed. All cannulae and tubing were sterilized by immersing in Zephiran-chloride solution for at least 72 hours and then rinsing with sterile saline immediately before use.

Group I. Five animals were prepared as follows under intravenous Nembutal anesthesia. Begin-

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ning 30 cm. from the ileocecal valve, a 60-cm. segment of ileum was separated from the continuity of the gastrointestinal tract and the end of the segment closed. Following anastomosis of the proximal and distal lines of transection (to establish gastrointestinal continuity) all venous return from the isolated closed loop was interrupted with silk ligatures. Perforated polyethylene catheters were laid in the peritoneal cavity and connected to a Y-tube which was brought out through the anterior abdominal wall during closure of the laparotomy wound. A combination of careful suturing and collodion seal prevented leakage of peritoneal fluid around the Y-tube. After closure of the anterior abdominal wall, the animal was placed in the prone position on a specially designed elevated table (with a central aperture) to facilitate gravity collection of peritoneal fluid. Duplicate ammonia determinations were carried out on 1- and 2-cc. aliquots of peritoneal fluids at 2-hour intervals until death of the animal.

Group II. Experimental procedures for this group of 5 animals were identical to those in Group I. Following venous strangulation in the isolated segment, however, attempts were made to maintain normotensive blood pressure by replacement infusion of whole blood and saline. Serial samples of peritoneal fluid were collected and analyzed as in Group I.

Group III. Five animals in this group which were given a 5-day oral antibiotic preparation with Sulfasuxidine and neomycin (on the 4th and 5th days) were subjected to the identical experimental procedures as outlined for Group I. At the time of operation 500 mg. of Aureomycin hydrochloride were injected into the closed, strangulated segment of small bowel. Peritoneal fluid was collected and analyzed as in Group I.

Group IV. Whole blood (250 cc.) was injected into the peritoneal cavity of 6 anesthetized mongrel dogs and the peritoneal fluid withdrawn at 2-hour intervals for the succeeding 10 hours through a previously placed indwelling polyethylene catheter. Additional samples were drawn the following morning, 24 hours after the intraperitoneal installation of whole blood. Duplicate ammonia determinations were obtained on 1- and 2-cc. aliquots of all samples.

Group V. In 5 adult healthy anesthetized mongrel dogs acute hemorrhagic pancreatitis was created by a previously described technique,⁵ illustrated in figure 1, in which trypsin (Tryptar),

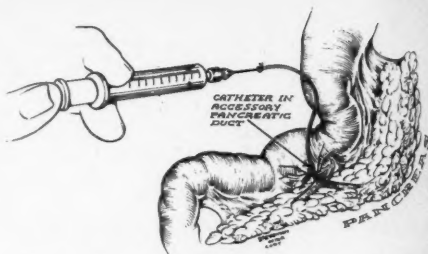


FIG. 1. Method of producing hemorrhagic pancreatitis. 250,000 units of tryptar injected under pressure into accessory pancreatic duct.

250,000 units in 20 cc. of sterile water, was injected through a No. 18 needle under pressure into the accessory pancreatic duct. Within 3 minutes following the injection of trypsin, the affected area of the pancreas (body and tail) were purplish-red in color and peripancreatic edema was obvious. Twenty minutes following injection of trypsin frank hemorrhage into the body and tail of the pancreas was apparent. Hemorrhagic ascitic fluid was collected from the peritoneal cavity in a manner identical to the collection in Group I and ammonia determinations on the fluid were obtained in duplicate on 1- and 2-cc. aliquots at 2-hour intervals until death of the animal. At death an immediate autopsy was performed and cultures of the peritoneal fluid obtained.

RESULTS

The experimental results, (table 1) indicate that the determination of ammonia in hemorrhagic peritoneal fluid might be helpful in the differential diagnosis of pathologic states resulting in hemorrhagic ascites. The ammonia levels in peritoneal fluid of animals subjected to strangulation obstruction were higher than the levels of ammonia in the hemoperitoneum and hemorrhagic pancreatitis groups of animals at all time intervals (fig. 2). It is obvious that prestrangulation sterilization of the intestinal tract significantly decreases ammonia formation in experimental strangulation obstruction. The experimental data also suggest that delay of the onset of peripheral hypotension retards somewhat the formation of ammonia in peritoneal fluid. The level to which ammonia rises in the peritoneal fluid in strangulation obstructions is apparently a function of (1) the duration of strangulation, (2) length of the involved segment and (3) the quantitative bacterial floral count in the strangu-

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TABLE 1
Peritoneal fluid ammonia levels in micrograms per ml.

	Time in Hours								
	0	2	4	6	8	10	12	18	24
Whole blood instillation in peritoneal cavity	0.58	0.78	1.62	1.96	1.93	0.75			0.71
Acute hemorrhagic pancreatitis		0.35	0.52	0.71	0.92	0.87*			
Strangulation obstruction		2.21	3.48	4.89	5.57*				
Strangulation obstruction with antibiotic sterilization of the gastrointestinal tract		1.82	1.70	2.15	2.34	2.45*			
Strangulation obstruction with whole blood replacement		1.91	2.98	3.62	4.62	6.31	10.11	23.13	49.90*

* Approximate average time of death for experimental animals of group.

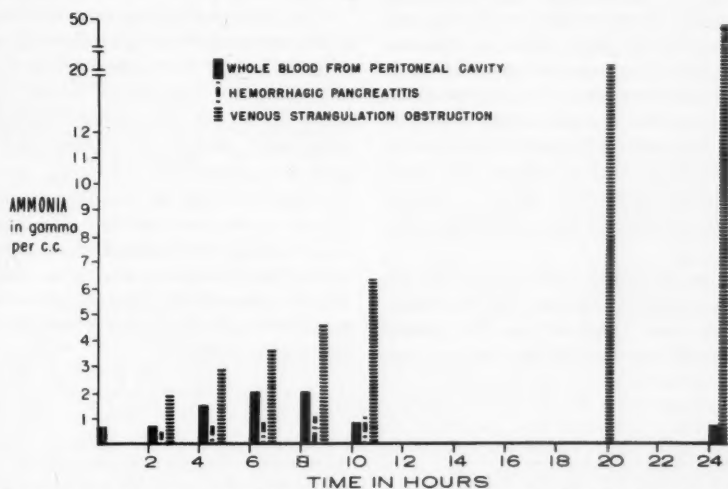


FIG. 2. Comparison of ammonia levels in hemorrhagic peritoneal fluid in dogs with whole blood in the peritoneal cavity, hemorrhagic pancreatitis, and venous (closed loop) obstruction of 60 cm. of ileum.

lated segment. These observations have been discussed by us in more detail in a previous report.⁶

It will be noted that the level of ammonia resulting from the installation of blood into the peritoneal cavity reaches a peak between 6 and 8 hours and gradually falls as the time interval between the placing of blood in the peritoneal cavity and sampling is increased beyond 8 hours. The rise in ammonia up to 8 hours in this group of animals is not unexpected. The level of ammonia in bank blood is somewhat dependent upon the time interval which has elapsed following its removal from the donor.⁸ The subsequent

fall in ammonia level is probably the result of chemical irritation of the peritoneum and dilution of instilled whole blood by hemoglobin-free peritoneal fluid. The fact that the ammonia level in this group of animals reached a level of approximately $2 \mu\text{g}$. is somewhat disturbing. The ammonia level of peritoneal fluid in strangulation obstruction is within the $2\text{-}\mu\text{g}$. range, in some instances, up to the 6th poststrangulation hour. This would seem to make the differential diagnosis between strangulation obstruction and hemoperitoneum from other causes when measured within this time interval, difficult if not im-

possible on the basis of ammonia concentration in peritoneal fluid alone. However, the highest hematocrit recorded in strangulated fluid in any experiment was 19. The few hematocrit readings recorded on the hemoperitoneum fluid animals (where blood was placed in the peritoneal cavity) were, of course, much higher. The hematocrit of 19 was found early following strangulation (2 hours). In all dogs subjected to strangulation of the small bowel, the hematocrit in peritoneal fluid decreased over the hours following the initial determination so that in all fluids examined at (10 to 12) hours poststrangulation the hematocrit was zero, indicating complete hemolysis. In the hemoperitoneum group of animals the fluid hematocrit levels, even after 24 hours, were still a substantial fraction of the initial hematocrit. Hematocrit determinations were not consistently done in the latter group so that we cannot draw any definite conclusions with respect to hematocrit at this point in the progress of the experiment. However, it seems unlikely that complete hemolysis would take place in an uninfected hemoperitoneum and that the fall in hematocrit observed can be explained for the most part by dilution with nonhemoglobin containing peritoneal fluid.

In the group of animals with pancreatitis the mean intraperitoneal fluid levels at all time intervals were less than 1 $\mu\text{g.}$ per ml. The highest single determination was 1.85 $\mu\text{g.}$ per cc. It is

well known of course that peritoneal fluid amylase and blood amylase levels can be elevated in intestinal obstruction³ and that amylase determinations alone cannot be relied upon in the differential diagnosis of this lesion. This can be true in high or low intestinal obstruction. Although the experiments to date suggest that the determination of ammonia levels alone on hemorrhagic peritoneal fluid may be a useful adjunct in a differential diagnosis of pathologic conditions resulting in hemorrhagic ascites, it is obvious that the future experiments should include the determination of peritoneal fluid and blood amylase levels as well as ammonia, and that hemoglobin and hematocrit measurements should be determined on the fluid in all experimental groups.

It is obvious that experimental data are desirable on fluid from animals with nonsterile pancreatitis and from animals with both sterile and nonsterile pancreatitis which have been supported by the intravenous administration of whole blood. Because the experimental data suggests that ammonia determination on peritoneal fluid may be of some aid in differentiating between clinical syndromes resulting in the accumulation of hemorrhagic peritoneal fluid, we have recently studied the peritoneal fluid of several patients from this standpoint. The possible value of ammonia levels is illustrated in the following brief case reports (table 2).

TABLE 2
Pertinent laboratory findings in patients with hemorrhagic ascites

Case No.	Initials	Peritoneal Fluid Amylase	Peripheral Blood Amylase	Peritoneal Fluid Hematocrit	Peripheral Blood Hematocrit	Peritoneal Fluid Ammonia	Peripheral Blood Ammonia	Color of Peritoneal Fluid	Diagnosis
		<i>Units</i>	<i>Units</i>			$\mu\text{g./cc.}$	$\mu\text{g./cc.}$		
1	A. C.	66	30	24	31	0.77	0.99	Red	Ruptured ectopic pregnancy
2	C. J. K.	7000 +	277	0	50	1.64		Dark red	Traumatic laceration pancreas
3	G. C.	80	122		49	79.7		Port wine	Strangulation obstruction ligament of Treitz to midtransverse colon
4	I. T.					7.7		Dark red to purple	Gangrenous colon, 10 cm.
5	W. G.	60		6	46	2.91		Pink watery	Gangrenous jejunum, 3 ft.

CASE REPORTS

Case 1. A. C., a 29-year-old housewife, was admitted on November 11, 1959, to the University Hospital emergency room with a chief complaint of abdominal pain, nausea and vomiting. Her symptoms had started 24 hours before admission. The abdominal pain was described as dull and aching and had been first noticed approximately 1 hour after she had engaged in strenuous exercise. The pain which was originally localized in both lower abdominal quadrants gradually spread to involve the entire abdomen and was aggravated by movement, deep breathing and coughing and partially relieved by rest. There was no history of recent trauma. She had had no menstrual irregularities.

Physical examination. The patient's temperature 99, pulse 110, respirations 26, and blood pressure 90/60. Examination of the abdomen revealed generalized abdominal tenderness, most marked in the lower quadrants. The abdomen was slightly distended, and there was some dullness to percussion in the flanks. Pelvic examination revealed the uterus to be approximately one and one half times normal size. The adnexae could not be adequately palpated because of tenderness and voluntary guarding. The cul de sac bulged slightly. No abnormalities were seen in roentgenograms of the chest and abdomen.

Laboratory data. Hemoglobin was 9.6 gm., hematocrit 31, and leukocyte count 26,000 with a relative increase in polymorphonuclear leukocytes. Urine, specific gravity 1.028, negative for albumin and sugar, normal in microscopic examination; blood urea nitrogen (BUN) 41 mg. per cent; CO_2 combining power 15 mEq.; blood amylase 30; and blood ammonia level 0.99 μg . per ml.

Hemorrhagic peritoneal fluid was obtained from an 18-gauge needle introduced in the left abdominal quadrant and the following laboratory data were obtained on this fluid: hemoglobin 7.3 gm., hematocrit 24, peritoneal fluid amylase 66 units, and peritoneal ammonia 0.77 μg . per ml. Smear revealed many red blood cells. Culture of the peritoneal fluid was negative after 72 hours.

After intravenous resuscitation with whole blood and parenteral fluids, a laparotomy was performed. Approximately 2500 cc. of bloody fluid was removed from the peritoneal cavity and a left salpingectomy was performed for a ruptured ectopic pregnancy. From this patient's history it is probable that she had been bleeding (at least intermittently) into her peritoneal cavity for approximately 24 hours before admission. The fact that her hemoglobin and hematocrit determinations on peritoneal fluid were substantial fractions of peripheral hemoglobin and hematocrit and were unhemolyzed in the 24-hour period paralleled

the experimental findings in animals in which whole blood was introduced into the peritoneal cavity. It is interesting that the peritoneal fluid hematocrit and ammonia levels are both 22 per cent below the same values for peripheral blood. It would seem that hemoglobin free fluid resulting from the chemical irritation of blood in the peritoneal cavity was responsible for dilution of intraperitoneal blood and resultant decreases in values as compared to peripheral blood. This would also suggest that there is little increase in ammonia values of free blood in the peritoneal cavity over a 24-hour period if infection is absent.

Case 2. C. J. K., a 28-year-old white man, was admitted to the University Hospital following an automobile accident in which he sustained a steering wheel injury of the lower anterior thoracic cage and epigastrium. At the time of admission he complained only of anterior chest pain. On admission his blood pressure was 110/86 mm. Hg, the pulse rate was 100, the respiratory rate was 24. Admission temperature was 98.2° F. Except for some superficial lacerations about the mouth, physical examination was within normal limits. X-rays of the abdomen, thorax and lumbosacral spine were negative. The hemoglobin on admission was 15.8 gm., hematocrit 50. A urine examination revealed a 1-plus albumin, 1 to 3 white blood cells per high power field (HPF) and 12 to 14 red blood cells per HPF. An emergency intravenous pyelogram revealed normally functioning kidneys. He remained in the emergency ward; observation during the night showed that his vital signs remained stable. However by 9 a.m. the following morning, he was complaining of some generalized abdominal pain which was most severe on his right side. The temperature at that time was 100° F. rectally, blood pressure was 130/85, pulse 92, and respirations 24. Examination of the abdomen showed generalized tenderness with some rigidity, most evident on the entire right side. Bowel sounds which had been present on previous examination were no longer audible. An abdominal tap was performed, and a small amount of dark peritoneal fluid was recovered. Laboratory studies on this fluid revealed the following: hematocrit zero, amylase in excess of 7,000 units, ammonia 1.64 μg . per ml. Smear of the peritoneal fluid was negative for bacteria. Culture of the fluid was negative after 72 hours incubation. The peripheral blood amylase on this patient was 277 units. These findings, of course, suggest traumatic pancreatitis. At exploration a very long superficial laceration was found in the body of the pancreas and this was repaired. The patient made a rapid and uneventful recovery. Only a small amount of blood stained fluid (300 cc.) was present in the peritoneal cavity

at the time of exploration. When compared to the experimental data, the peritoneal fluid findings in this patient suggest traumatic pancreatitis without serious involvement or perforation of the gastrointestinal (GI) tract. The lack of striking elevation in the peritoneal fluid ammonia suggests that the peritoneal fluid was not coming from the GI tract. The findings of a markedly elevated peritoneal fluid amylase was, of course, the most important clinical finding in the differential diagnosis of this patient.

Case 3. G. C., a 21-year-old Negro man with a 2-year history of duodenal ulcer, was admitted to the emergency room of University Hospital complaining of diffuse severe abdominal pain following a 4-day alcoholic "binge." The pain, which was followed by vomiting, had started 18 hours before admission and was described as sharp, diffuse and constant. His history revealed that he had been jaundiced on at least 2 occasions following a similar prolonged alcoholic episode. Physical examination revealed temperature of 99° F., pulse rate of 130, respirations 25, blood pressure 80/60. The abdomen was slightly distended, tense and diffusely tender with rigidity in all quadrants. Percussion revealed some dullness in the flanks. Peripheral blood hematocrit was 49, white blood cell count was 31,000 with a relative increase in polymorphonuclear leukocytes. Blood amylase was 122 units. A saphenous vein cut down was performed and antishock measures instituted. A peritoneal tap revealed hemorrhagic fluid which was reddish-brown in color. Hemoglobin and hematocrit determinations were not obtained on this fluid. The peritoneal fluid ammonia level, however, was 79.7 $\mu\text{g. per ml.}$ and the peritoneal fluid amylase was 80 units. X-ray examination of the abdomen showed a segmental (jejunal) ileus and no evidence of free air in the peritoneal cavity. The patient had a cardiac arrest on route to the operation suite. All attempts to resuscitate him were to no avail. Autopsy examination revealed a normal pancreas, a chronic duodenal ulcer and an infarcted jejunum, ileum, cecum and appendix. Careful examination of the superior mesenteric artery and vein failed to reveal a cause for the infarction.

The extremely high figure for ammonia in the peritoneal fluids suggests that the cause of hemorrhagic fluid in the peritoneal cavity was infarcted bowel. It is interesting to note that this diagnosis was not entertained by any of the several observers who saw this patient before the time when hemorrhagic peritoneal fluid was withdrawn from his peritoneal cavity; the only 2 clinical diagnoses entertained were those of perforated duodenal ulcer and acute hemorrhagic pancreatitis. When bloody peritoneal fluid was aspirated, several ob-

servers felt more secure in their diagnosis of acute hemorrhagic pancreatitis. However, amylase determinations on blood and peritoneal fluids suggested that this diagnosis was erroneous. The high peritoneal fluid ammonia level, when interpreted in the light of experimental findings in animals, suggested venous strangulation of the small bowel. Even if the peritoneal fluid and blood amylase had been elevated, the extremely high ammonia level of the peritoneal fluid would have been in favor of a diagnosis of infarcted bowel rather than acute hemorrhagic pancreatitis.

Case 4. I. T., a 31-year-old housewife was admitted to the University Hospital on August 13, 1959, with a diagnosis of squamous cell carcinoma of the anus. The mass measured 10 by 12 cm., and there were no obvious inguinal node metastases. A descending colon colostomy was performed on August 19, 1959, and the tumor was subsequently treated by irradiation therapy. At the time of maximal expected regression from x-ray therapy, September 22, 1959, an abdominoperineal resection and periaortic node dissection were done. Twenty-four hours later the descending colon colostomy was dusky in color. On the 2nd post-operative day the colostomy was even darker in color. By the following morning, the colostomy was obviously gangrenous although the patient had discharged fecal material from it during the night. Even though it was now obvious that the intraperitoneal portion of the colon would have to be examined, there was some question as to whether or not the gangrenous process had extended into the peritoneal cavity. A peritoneal tap in the flank just below the colostomy site produced hemorrhagic peritoneal fluid. A hematocrit was not obtained on this fluid. Ammonia level, however, was 7.7 $\mu\text{g. per ml.}$ suggesting extension of the gangrenous process into the peritoneal cavity. At abdominal exploration the same morning, 10 cm. of gangrenous descending colon were removed from the intraperitoneal portion of the descending colon, and a new colostomy was constructed. The patient made an uneventful recovery.

Case 5. W. G., a 29-year-old man was admitted to the University Hospital following an acute onset of abdominal pain 24 hours previously. At first the pain was intermittent and crampy in nature and associated with vomiting. Several hours (6 to 8) before admission the crampy pain disappeared and was replaced by a steady, aching generalized discomfort. The patient had had no bowel movements since the onset of pain and had not vomited for 6 hours before admission. Pertinent physical findings revealed the patient's blood pressure to be 120/90 mm. Hg, the temperature was 98.6° F., the pulse 100, and the respirations 22. The patient had generalized abdominal tenderness and rigidity

upon palpation. There were no organs or masses palpable. The abdomen was not distended. The peripheral blood hemoglobin was 15.6 gm., the white blood cell count 13,900. Urine specific gravity was 1.035; there was a trace of albumin but no sugar. The acetone was 2-plus and the microscopic examination of the urine sediment was negative for bacteria. Peripheral blood amylase was 60 units. A flat plate of the abdomen was negative. An abdominal tap revealed the presence of hemorrhagic (pink) fluid. The hematocrit of the fluid was 6 and the supernatant was clear, indicating little or no hemolysis. Peritoneal fluid ammonia level was 2.91 μ g. per cc. A smear of the peritoneal fluid was negative, but subsequent culture revealed a moderate growth of *Clostridium perfringens*. Exploration of the abdominal cavity revealed a volvulus involving approximately 3 feet of small bowel with a point of torsion about an omphalomesenteric duct attached to a Meckel's diverticulum.

The intraperitoneal fluid ammonia level while only slightly elevated was still high enough to suggest bowel involvement by an early, strangulating process especially when the hematocrit level of the peritoneal fluid was 6, and there was no gross hemolysis. It is, of course, possible that other pathologic processes could have caused this combination of findings.

SUMMARY

The experimental and clinical findings suggest that the determination of ammonia in the peritoneal fluid may be a useful adjunct in the differential diagnosis of intraperitoneal conditions resulting in hemorrhagic ascites. The authors realize that additional and more complete experi-

mental and clinical data are necessary before any distinct correlation or conclusion can be drawn.

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TETANUS IN LOUISVILLE

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Tetanus has been a known clinical entity since at least the time of Hippocrates. All manner of etiologies were described, but the genesis of modern concepts did not come until the eighteenth century (1797) when Von Lingalsheim and Michaelis suggested that tetanus might be due to irritation of the peripheral nerves by secretions of the nerves. Nicolier in the nineteenth century (1881) identified the organism *Clostridium tetani* in mixed culture. Just eight years later Kitasato obtained the first pure culture with which clinical tetanus could be produced, and suggested that the symptoms were due to poison absorbed from the local area. A year later Von Behring and Kitasato suggested that immunization was possible. This assumption was the basis for serum therapy.

Pathophysiology. *C. tetani* is not a clear-cut species in that some forms are identical morphologically yet are nontoxic, whereas others are highly toxic. Further, the organism produces two exotoxins: tetanospasmin and tetanolysin.

Tetanospasmin is a neurotoxin and one of the most powerful poisons known. It is extremely labile and easily destroyed by a variety of physical and chemical agents. Toxin production is enhanced markedly by symbiotic organisms. It is supposed to cause clinical tetanus.

Tetanolysin, on the other hand, is a hemotoxin capable of destroying erythrocytes and leukocytes and is thought to be produced by the non-pathogenic organisms. It may be the cause of local tetanus.

There are three principal theories of action of toxin, none of which, according to Drew, are completely tenable. These theories are: (1) neural transport, (2) arterial transport and (3) destruction of acetylcholinesterase by the toxin which leads to increased acetylcholinase, which in turn leads to increased muscle irritability.

Mortality rate. Clinical tetanus is a deadly disease even with the most modern therapy. The

lowest mortality rate appears to be that reported by Diaz-Rivera of Puerto Rico (13.3 per cent), and the highest rate is in this country (50 per cent) (table 1).

Causes of death. These are: (1) exhaustion, (2) circulatory failure and (3) asphyxia.

Age incidence. Generally tetanus is considered to be a disease of the young and the old in civilian life. From patients studied in Louisville hospitals it may be seen that all decades of life are represented (table 2).

Incubation period. In the literature much stress is placed upon the incubation period and the onset period. By the latter is meant the period of time between the onset of clinical signs of tetanus and the first convulsion. The reason for such emphasis lies in its prognostic value in a particular case (table 3). Spores may enter a wound and have enough foreign material from dirt or clothing to cause local necrosis which permits them to grow. On the other hand, they may lie dormant until a subsequent contusion or surgery produces the traumatized tissue for their growth.

Types of injury. The injury which leads to tetanus infection is often a minor one (table 4). This strengthens the argument for active immunization of all individuals.

Symptomatology. Awareness of symptoms will assist in early diagnosis (table 5).

Laboratory. Review of the cases in question shows the small value of the laboratory as a diagnostic aid. Tests of complete blood count (CBC), blood culture, spinal fluid, urine and wound culture were of little aid. Only one wound culture of *C. tetani* was found. EEG results were run in nine cases, all with convulsions. The original EEG in all interpretations was convulsions, not cortical in origin. However, when repeated, EEG improved; this served as a prognostic indication to the outcome. These results demonstrate that tetanus should be diagnosed clinically, and that the diagnosis does not require laboratory confirmation. The contribution of the laboratory lies in its aid in the general care and prognosis of the patient.

Presented before the 28th Annual Assembly of the Southeastern Surgical Assembly of the Southeastern Surgical Congress, New Orleans, Louisiana, March 21 to 24, 1960.

TABLE 1

*Tetanus in Louisville hospitals, July 1, 1948 to July 1, 1958**

Cases diagnosed tetanus.....	45
Cases diagnosis questionable....	3
Total.....	42
Deaths.....	16
Mortality.....	38%

* No cases from V.A. Hospital.

TABLE 2

Age incidence

Age Group	No. of Cases
70-80 or above.....	6
60-70 or above.....	4
50-60 or above.....	1
40-50 or above.....	2
30-40 or above.....	6
10-20 or above.....	9
1½-10 or above.....	10

TABLE 3

Relationship of injury to symptom onset

Days	No. of Cases
2	2
3	3
4	2
5	1
7	10
8	1
9	1
10	2
14	4
17	1
21	5
28	1
64	1

Immunization. Active immunization is the prophylactic method of choice. In the American Armed Forces during World War II, of over 2,700,000 hospital admissions, disregarding the many other minor wounds which could have produced tetanus, there were 12 cases of tetanus. Among these 12 cases there were 5 deaths. The figure is more striking when it is realized that only 6 of the patients had had their basic immunization, and of these 6, only 4 had had a booster at the time of injury.

Passive immunization. Passive immunization is always second best (table 6). It carries definite risks of anaphylaxis, serum sickness and loss of value with each successive use, in addition to marked loss of value if desensitization adminis-

TABLE 4

Type of injury

Type of Injury	No. of Cases
None.....	12
Puncture wounds.....	16
Nail	
Stick	
Splinter	
Thorn	
Knife	
Laceration.....	6
Fight	
Brick	
Contusion.....	1
Abrasion.....	4
Blister.....	1
Scratch (kitten).....	1
Fracture forearm, (cast 2 mo., abscess).....	1
Total.....	42

TABLE 5

Symptomatology

Headache, prodromal
Anxiety
Pain in back, legs, arms, neck
Dysphagia
Trismus
Convulsions

TABLE 6

Immunization history

No immunization.....	37
Immunization: antitoxin.....	3
Diphtheria, pertussis, tetanus without booster.....	1
Diphtheria, pertussis, tetanus with booster (questionable)...	1
Booster: questionable prior immunization.....	1
Toxin-antitoxin: 17 hr. prior to admission (death 7 days after injury).....	1

tration becomes necessary. No accurate figures are available on anaphylactic deaths; however, Lamson was able to collect 41 such cases. Other figures obtained are 1 death in 50 thousand, or 0.5 per cent.

When this method is used, the availability of bovine serum as well as transfusion from an actively immunized person should be kept in mind.

Many feel that if the skin test is positive, the eye test should be administered. If the latter remains negative, the serum may be given with care; however, if the eye test is positive too, then the antitetanic serum should be given only if the indication is absolute.

Passive immunization for tetanus received its impetus in World War I, as a result of the lowered incidence of tetanus following the use of this method by the British Armed Forces. At that time much smaller doses of the serum were used than are now advocated. Before its use, wounds were treated by the closed method; however, the practice of debridement was employed almost simultaneously with passive immunization and apparently has not received the same recognition as a prophylactic measure. Many authors still feel that for the unimmunized, passive immunization should be employed. A comparison of the anaphylaxis figures (which are obviously not complete), the morbidity from serum sickness, mortality in spite of antitoxin use and the number of passive immunizations given each year, with the number of tetanus cases and the deaths which follow, leads me to believe that such immunization is not justified. Rather these accidents should present an opportunity to immunize the unimmunized actively.

Active immunization. This may be obtained by either the alum precipitated or the fluid toxoid method. The basic immunization consists of two shots of 0.5 cc. of the alum precipitated toxoid given 4 to 6 weeks apart, followed by a third dose administered 1 year later. The Armed Forces of the United States administer a booster every 4 years. Peterson *et al.* as well as Stafford *et al.* have proved that persons tested, subsequent to adequate basic immunization, responded to a stimulating dose of toxoid for up to 11 years. Peterson *et al.* found that it made no difference whether the fluid or alum precipitated toxoid was used, and further, that a good response was obtained from 0.25 cc. It should be stressed that there is

no response to toxoid if basic immunization of at least two doses at the suggested interval are not given. The one exception to this is the work of Varney which appears to be valid. In this method the intradermal administration of 0.5 cc. of toxoid in multiple sites produces immunization. Pain and possible slough are two problems in this method.

The question frequently raised concerns the delay of 4 to 6 days in serum response to a booster dose of toxoid at the time of injury. Should antitoxin be used instead of, or in conjunction with toxoid? In World War II, the British Armed Forces gave 1500 units of antitoxin instead of giving a booster of toxoid. They had 22 cases in comparison with the American 12. Cooke and Jones definitely feel that antitoxin administration interferes with the sensitization to toxoid, while Ramon, Varney, and Miller believe the contrary.

Treatment of Tetanus. As may be deduced from the mortality figures, no uniform or ideal therapy has yet been devised; however, as therapy has been directed to certain general principles, mortality has been greatly reduced. The principles to which the therapy has been directed are (1) arrest of free tetanus toxin action, (2) prevention of muscle spasms, and (3) prevention of aspiration pneumonia. It has been accepted that once the toxin has become fixed in the cord and brain, antitoxin will not affect it; however, prior to this it may be neutralized. Tetanus is a self-limiting disease with complete recovery but without natural immunity.

With regard to the blocking of tetanus toxin, many methods of administering antitetanic serum have been used. They range from large intramuscular and intravenous doses to moderate doses, also with repeated daily doses, and some intrathecal use. Since antitetanic serum is injurious to the cord, the intrathecal route should not be used. The intravenous administration of serum is debatable. The daily administration of tetanus antitoxin is not necessary and leads to sensitization which complicates therapy. It appears logical to administer an initial dose of 100,000 units of antitoxin serum, either half by vein and half in the muscle or else all intramuscularly. It further seems reasonable to repeat the use of this drug at weekly intervals in dosage of 10,000 units, as long as the wound, if present, is septic.

The control of muscle spasm is the most difficult part of therapy, and no method used has been completely successful unless given to the point of complete paralysis.

Cooke uses rectal Avertin, 80 mg. per kg. of body weight, expecting to give an additional 20 to 40 mg. thereafter. Diaz-Rivera employs mephenesin in 1 and 2 per cent solution intravenously, using the former 100 to 300 cc. in 500 cc. glucose and distilled water at the rate of 60 drops a minute, with the 2 per cent solution connected so that it may be used immediately. Oral mephenesin is ineffective, and intravenous complications of the drug are thrombophlebitis, hemolysis, and hemoglobinuria. Powell uses tubocurarine given in doses of 10 to 15 mg. using muscular twitchings as an indication for repeated dosage. Prostigmin and Tensilon will counteract this drug. When either of these drugs is used, mechanical respirator devices and oxygen should be readily available.

Control of aspiration is attempted by intravenous instead of oral nutrition and cleansing of the tracheobronchial tree. Particular emphasis upon fluid and electrolyte balance is most important during the early crucial days of the disease. Special, well trained, and alert nursing care around the clock is a must, along with early tracheotomy. The latter is often done reluctantly and too late.

Wound care should be limited to the obviously infected wound and consists of incision and drainage or debridement of the wound. It should be done under anesthesia.

SUMMARY

1. Statistics on tetanus from the Louisville hospitals for a 10-year period, July 1, 1948 to July 1, 1958, are presented.

2. A general review of tetanus is made.

3. Active and passive immunization are reviewed, and an urgent plea for active immunization of all persons is made.

4. An outline of a sound regime for the treatment of tetanus is presented.

5. This author feels justified in not giving tetanus antitoxin prophylactically and intends to employ complete active-immunization only.

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MASSIVE GASTROINTESTINAL HEMORRHAGE DUE TO HEREDITARY HEMORRHAGIC TELANGIECTASIA*

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Hemorrhage from the gastrointestinal tract continues to be a frequent and often difficult problem for the physician. When the site of bleeding cannot be localized by our present modes of preoperative investigation, the problem increases in magnitude. Approximately 15 per cent of patients with gastrointestinal bleeding are classified initially as bleeding from an unknown or obscure site. Continued follow-up of this group reveals a large number with peptic ulcer disease. The remaining patients may have bleeding from some of the uncommon entities. In the patient with gastrointestinal hemorrhage from some unknown etiology, one should keep in mind the possibility of hereditary telangiectasia.

Five patients with recurrent, often massive, gastrointestinal hemorrhage due to hereditary telangiectasia have been encountered during the past five years. Because of the paucity of cases cited in the surgical literature, these are presented to re-emphasize the importance of recognizing this disease as a possible cause of massive bleeding.

CASE REPORTS

Case 1. (M. B. C19141) This 56-year-old Negro woman was initially admitted to Grady Memorial Hospital, Atlanta, Georgia, in August of 1955 with a history of exertional dyspnea and palpitation of one year duration. A complete diagnostic study including x-rays of the gastrointestinal tract revealed only an iron deficiency anemia and guaiac positive stools. Her anemia responded to oral iron therapy and her symptoms of dyspnea diminished. She was discharged from the hospital with a diagnosis of gastrointestinal bleeding of unknown etiology.

The patient was readmitted to the hospital on three subsequent occasions with the same complaints of dyspnea and palpitation, and on each

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admission was found to be anemic. One month before her last admission, June 1956, she had noted bright red blood in her stools and gave a history of coffee ground vomitus on one occasion. Repeat x-ray studies of the gastrointestinal tract were again not diagnostic. There was evidence of continued gastrointestinal bleeding during her last hospitalization which required 3000 cc. of whole blood for replacement. Because of this, a laparotomy was performed on June 12, 1956. No cause for the bleeding could be found and a "blind" gastrectomy was performed. No further bleeding occurred in the postoperative period and the patient was discharged from the hospital. She had received a total of 5500 cc. of whole blood during this admission.

One month following surgery the patient was again admitted to the hospital because of weakness and a hemoglobin of 6.9 gm. per cent. Repeat examination of the gastrointestinal tract, including esophagoscopy, x-ray studies of the stomach, small bowel and colon, and proctoscopy was negative. Hematologic studies, including a bone marrow study, were also negative. The hematologist felt that the only possible defect in this patient could be a hereditary hemorrhagic telangiectasia involving the gastrointestinal tract. A search for this lesion in the skin and mucous membranes was negative.

On September 13, 1956, the patient was re-explored and found to have multiple 1 to 2 cm. dark hemorrhagic areas in the mucosa of the small bowel beginning in the midjejunum and extending to the ileocecal valve. A biopsy of one of these lesions proved it to be a hemorrhagic telangiectasia. No resection was performed.

The patient has been followed at frequent intervals since 1956 and has been readmitted on several occasions for whole blood replacement.

Case 2. (S. S. C51160) This 73-year-old Negro woman was admitted to Grady Memorial Hospital, Atlanta, Georgia, on July 11, 1959, with a history of hematemesis and melena beginning six days before admission. The patient gave no history of previous similar episodes or any history of epigastric pain suggestive of peptic ulcer disease. Stool examinations and gastric aspirants were positive for blood. She received 1500 cc. of whole

blood with a rise of her hematocrit from 16 to 29 per cent. An emergency gastrointestinal series revealed only a filling defect in the antrum of the stomach suggestive of a large clot of blood.

Because of the continued gastrointestinal bleeding a laparotomy was performed. Gastrotomy, esophagoscopy, and duodenostomy revealed no definite site of active bleeding. Because of the patient's age and general physical condition the surgeon decided not to do a "blind" gastrectomy.

Gastrointestinal bleeding recurred postoperatively, necessitating repeated transfusions. The patient developed bronchopneumonia and died on July 19, 1959. An autopsy revealed three telangiectatic lesions in the antrum of the stomach. A search throughout the remainder of the gastrointestinal tract revealed no other lesions. None were noted in the mucous membranes of the nose and mouth or in the skin.

Case 3. (J. P. C1502) This 67-year-old Negro woman was first admitted to Grady Memorial Hospital, Atlanta, Georgia, on January 29, 1958, with a history of tarry stools and weakness. Two days before her admission to the hospital she had noted bright red blood in the stools. Her past history was essentially negative. Complete x-ray studies of the gastrointestinal tract revealed only diverticulosis of the sigmoid colon. Proctoscopy was negative. Her gastrointestinal bleeding ceased after she received three units of whole blood and supportive therapy. She was discharged from the hospital for outpatient follow-up. The diagnosis at this time was gastrointestinal bleeding of obscure origin.

The patient was readmitted to the hospital on June 24, 1958, with anemia. She had returned to the hospital because of an increase in the severity of her angina, which had been diagnosed on her initial admission. Her hematocrit at this time was 15 per cent. Again gastrointestinal bleeding was evidenced by guaiac positive stools. Repeat diagnostic studies of the gastrointestinal tract again revealed only diverticulosis of the sigmoid colon. At this time a diagnostic of bleeding due to diverticulosis was entertained. She was transfused with three units of whole blood and discharged from the hospital after remaining stable for a period of one week.

The patient's third admission occurred in July of 1958 as a result of recurrent anemia. She was again transfused. Because of the severity of her angina, it was felt that a laparotomy was not feasible at this time. She was discharged from the hospital after remaining stable for a period of two weeks.

The patient was readmitted to the hospital on December 8, 1958, with evidence of coronary insufficiency and a hemoglobin of 4.8 gm. per cent.

After being transfused, the patient had a complete re-evaluation of the gastrointestinal tract, with no definite site of bleeding other than the diverticulosis of the colon being demonstrated. The bleeding episodes and hospital admissions were again repeated in February and May of 1959. Following her last admission, re-evaluation of the patient was begun. A small polyethylene catheter was passed into the stomach and upper small bowel with aspirations being taken at various levels. With the catheter in the upper jejunum, bright red blood was obtained on one occasion. The diagnosis of hereditary hemorrhagic telangiectasia was entertained at this time. A laparotomy was performed on June 29, 1959. Multiple telangiectatic lesions were encountered beginning in the jejunum and extending to the ileocecal valve. A biopsy of one of these lesions confirmed the diagnosis. Because of the patient's cardiac condition and the extensive involvement of her small bowel, no resection was performed. She was maintained on frequent blood replacements. At the present time she is being followed in the Gastrointestinal Clinic. This patient's total blood replacement through her last admission has been 40 units of whole blood.

Case 4. (R. S. A35377) This 58-year-old textile worker was admitted to Grady Memorial Hospital, Atlanta, Georgia, on July 6, 1954, with a complaint of weakness and shortness of breath. The patient's present illness was of two to three weeks' duration. Two days before his admission he had vomited a small amount of black material and one day before admission he had bright red hematemesis. He complained of no pain in the abdomen at any time. In 1949 this patient had been admitted to this hospital with a similar history, and had required 20 units of whole blood for replacement. A laparotomy had been performed at that time, revealing hemorrhagic telangiectasia involving the small bowel from the ligament of Treitz to the ileocecal valve and also an area on the transverse colon. Lesions were described as small and mulberry-shaped. A biopsy was obtained and the pathologic report was that of hereditary hemorrhagic telangiectasia.

The patient gave a family history of one sister who died at the age of 50 of a "bleeding disease."

Physical examination revealed multiple small hemangiomas scattered over the skin surfaces; otherwise, the examination was negative. Hematologic studies revealed only a hemoglobin of 9.5 gm. per cent. A barium swallow was negative.

On the 9th hospital day the patient went into shock and whole blood transfusions were started at this time. Seven hours later the patient vomited copious amounts of bright red blood, and massive amounts of dark red blood were evacuated from

the rectum. Multiple transfusions were continued. Because of the extensive involvement of the gastrointestinal tract with telangiectatic lesions observed at the patient's initial surgical procedure in 1949, it was decided to attempt to sustain this patient with repeated transfusions. However, after a total of 40 units of whole blood over a 3-day period, laparotomy was chosen as a last resort. In July 1954, the patient was explored and found to have telangiectatic lesions involving the jejunum and the upper ileum. This large segment of small bowel was resected. The resected specimen revealed multiple, large mulberry-like areas resembling submucosal hematomas. The mucosal and serosal surfaces contained innumerable small, red punctate lesions throughout.

The patient continued to bleed postoperatively and died on the first postoperative day. An autopsy was obtained. Telangiectatic lesions were found in the remaining short segment of jejunum and extending to within 3 cm. of the ileocecal valve. These measured from 4 to 6 mm. in diameter. Submucous hematomas measuring up to $1\frac{1}{2}$ cm. protruded into the lumen of the bowel. Similar lesions were found in the esophagus. Microscopic examination revealed hemorrhage into the mucosa. In many areas, the blood in the mucosa was found to be surrounded by an endothelial lining, establishing the diagnosis of telangiectasia.

Case 5. (V. D. 14-416U) This 16-year-old white girl was first seen in September of 1958 with a complaint of dizziness, and a history of anemia.

Her past history revealed that she had been anemic at the age of 11. Exhaustive diagnostic studies were performed and were unsuccessful. Her anemia responded to iron therapy. In May of 1958 she had stopped her iron therapy and 4 months later had begun to have episodes of dizziness and weakness. Hematologic studies revealed a hemoglobin of 5.9 gm. per cent, a hematocrit of 21 per cent, and 2.4 million red blood cells per cc. In 1948 a cavernous hemangioma had been excised from the patient's back. There was no family history of any bleeding tendency.

Further examination revealed that the patient had guaiac positive stool. A complete study of the gastrointestinal tract was performed. No intrinsic lesions could be demonstrated. Oral iron therapy was reinstituted and after discharge from the hospital the patient did well, with her hemoglobin returning to a level of 12.4 gm. per cent.

The patient was readmitted to Emory University Hospital on December 9, 1958, with a tentative diagnosis of Meckel's diverticulum. On December 10, she was explored and found to have multiple hemorrhagic areas of the small bowel and in the transverse colon. A 6-inch segment of the distal jejunum was resected to remove three of the



FIG. 1. Hemorrhagic areas in small bowel demonstrated at laparotomy in Case 5.

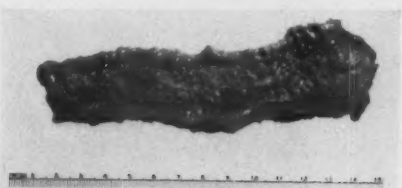


FIG. 2. Opened specimen resected from Case 5 demonstrating mulberry appearance of lesions.

large clusters. The remaining lesions in the transverse colon and small bowel were excised locally. A total of 10 lesions was removed. The patient's postoperative course was uneventful, and she was discharged from the hospital on the 10th postoperative day. Pathologic studies of the specimen revealed multiple telangiectatic lesions of the jejunal segment, and similar lesions excised from the transverse colon and small bowel. It was felt that this represented a case of multiple hereditary telangiectasia (figs. 1-3).

The patient was recently seen and examined and showed no evidence of recurrent gastrointestinal bleeding.

DISCUSSION

Hereditary hemorrhagic telangiectasia is a well documented disease known by many synonyms. The most popular is Osler's disease, or Rendu-Osler-Weber disease. Bagington¹ was probably the first to record a case of hemorrhagic telangiectasia in 1865. Later, Rendu²¹ described a family with this condition and designated it as pseudohemophilia. The reports of Sir William Osler^{17, 18} clarified the character of the disease and distinguished it from a group of obscure hemorrhagic disorders. The difference between hemorrhagic hereditary telangiectasia and hemophilia was noted by Weber.²⁰ Hanes¹² described the histology of the disease and designated it as hereditary hemor-

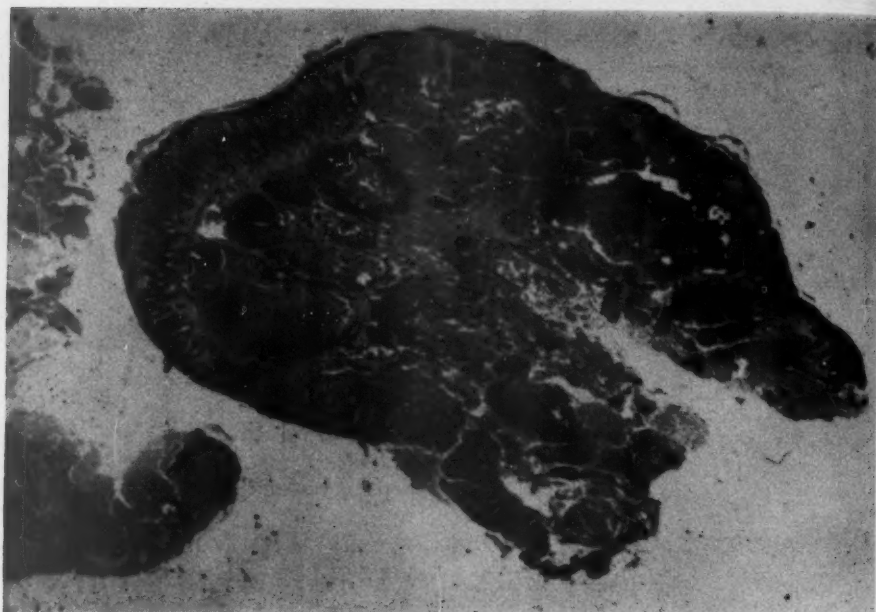


FIG. 3. Histologic section of telangiectasia removed from Case 5 demonstrating blood-filled vascular spaces lined by thin endothelium.

rhagic telangiectasia. Goldstein¹⁰ reviewed the medical literature related to the disease in 1931, and named it Goldstein's heredofamilial angiomatosis. The disease has been reviewed extensively in the literature.

The lesions of this disease are most frequently encountered in the mucous membranes. They may appear within any of the body viscera and manifest themselves by recurrent episodes of bleeding. In Goldstein's¹⁰ review, epistaxis and multiple telangiectasia on the face, in the nasal septum, and in the mouth were the most frequent manifestations of the disease. Bleeding from the stomach, bowel, lung, kidney, bladder, liver, brain and meninges resulting from telangiectatic lesions indicates the widespread distribution of such lesions.

Numerous reports attest to the hereditary transmission of hemorrhagic telangiectasia.^{9, 10-19, 23} In one "family reunion,"²⁴ a study of a large family revealed 32 of 170 with lesions. The mode of transmission was that of a simple autosomal dominant. Many patients with hemorrhagic telangiectasia and no characteristic family history have been reported. This has been explained on the basis of atavism or "skipped generations" in the inheritance of the disease.⁷

From the telangiectatic lesions, hemorrhage is quite profuse and has been described as pulsatile, although lesions that are visible in the nasal mucous membranes did not pulsate.⁴ When bleeding occurs, bright red arterial blood is usually seen escaping from the lesion.

Usually the lesions are described as either elevated or flat and punctiform. They may vary in size from 1 to 2 mm. to 1 cm. in diameter. The differentiation of the vascular spider that is often associated with liver disease, from that of the lesion of hereditary hemorrhagic telangiectasia, is well described by Bean.³ The telangiectatic lesion that involves the viscera may well have a mulberry-like appearance when an associated hematoma develops. Histologically the lesions are composed of localized dilatation of capillaries and venules forming a distinct group.^{5, 12} Singer and Wolfson²² state that the lesions are localized gross abnormalities of capillaries and are usually not accompanied by any systemic capillary dysfunction. Bean³ describes the basic finding as a thinning of the walls of the vessel with attenuation of the muscular coats, leading to a bulging or dilation of the wall. This defect may become extensive enough to give rise to coiled masses of aneurysmal vessels. However, Bird and Jaques⁵

state that the telangiectatic lesions primarily involve large and small veins.

Various methods of therapy have been utilized on patients with known telangiectatic lesions. Agents such as calcium, iron, arsenic, liver extract, and parathormone have been utilized without much success. Rutin has been advocated for patients with gastrointestinal bleeding.^{13, 15} Koch, Escher and Lewis¹⁴ reported a decrease in the incidence of the severity of epistaxis in five cases with the use of estrogen and androgen therapy. It was felt that this hormone therapy improved the texture of the nasal mucous membrane and thereby increased protection of the telangiectatic lesions from trauma. Topical application of various caustics and even the use of electrocoagulation have not been met with complete success.²

In the patient with gastrointestinal bleeding of undetermined or obscure etiology, the presence of telangiectatic lesions of the nasal septum or in the region of the face may provide a clue to the etiology of the gastrointestinal bleeding. Cases of massive gastrointestinal hemorrhage due to this disease have been described.^{11, 13, 15} In Driscoll's report,⁶ 100 cases with telangiectatic lesions reported in the literature were reviewed. Seventeen of this group apparently had gastrointestinal bleeding due to the telangiectatic lesions. Gastroscopy and sigmoidoscopy are strongly advocated for patients with obscure bleeding, as a possible aid in obtaining a diagnosis. The diagnosis can be made only if the condition is kept in mind when cases of bleeding from the gastrointestinal tract arise which are of obscure origin.

In Case 1, recognition of the lesions involving the small bowel at the time of initial laparotomy might well have spared the patient a subtotal gastrectomy. At the second procedure it was readily realized that no massive resection could be attempted to eradicate the lesions. Furthermore, once the lesions are removed, whether individually or by resection of segments of the gastrointestinal tract, one is never assured that other lesions are not present in remaining portions of the gastrointestinal tract as well as in other body viscera.

In contrast, Case 2 represents a situation in which a "blind" gastrectomy may well have prevented exsanguination, since the lesions were demonstrated to be localized primarily in the stomach. However, these were not recognized at the time of laparotomy.

For the third patient a tentative diagnosis of bleeding from diverticulosis of the sigmoid colon had been made. Had not this patient had severe cardiac disease, she might have been submitted to a sigmoid colectomy early in her hospital admissions. Only after determining that blood was present in the upper small bowel was a diagnosis of Osler's disease entertained. This was confirmed by biopsy of one of the many lesions involving the small bowel.

In the fourth case the patient was admitted with a known diagnosis of hemorrhagic telangiectasia involving the gastrointestinal tract. When bleeding could not be controlled by conservative measures and replacement therapy, laparotomy was the only possible solution. However, the lesions were even more extensive than had been previously ascertained. At autopsy this patient had involvement of the esophagus as well as the colon with telangiectatic lesions. This again demonstrated the universal involvement that this disease may present.

The fifth case represents a patient in whom isolated lesions could be resected and small lesions excised with good results. Of course, we are still not assured that this patient will not return with further bleeding from some site due to telangiectatic lesions.

In all the cases reported here, no history was obtained that was suggestive of peptic ulcer disease. For only one of the patients reported was a history obtained in which some other member of the family had a "bleeding tendency."

SUMMARY

The history and literature related to hereditary hemorrhagic telangiectasia have been reviewed. Five cases with recurrent and often massive gastrointestinal bleeding due to this disease are reported. Diagnosis of this entity was established by laparotomy and pathologic studies of the lesions. Because of the extensive involvement of the gastrointestinal tract in four patients, surgery only established the diagnosis, but did not remove the cause. However, in one patient a segmental resection and multiple excisions of the lesions have yielded good results.

Hereditary hemorrhagic telangiectasia should be considered in every case of gastrointestinal bleeding of unknown origin.

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CLINICAL APPLICATIONS OF BLOOD VOLUME DETERMINATIONS IN SURGERY*

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The future expansion of our frontiers of surgery is dependent not so much on new techniques of operation as upon the development of a better understanding of the chemical and physiologic conditions during pathologic states of the body, and the development of methods to restore these conditions to normal. One of the more important problems which needs understanding and clarification today is the regulation of the blood volume, both preoperatively and postoperatively.

Hemoglobin and hematocrit determinations are widely used as "absolute indices," but these are actually a measure of the relative concentration of hemoglobin, or red cells, and plasma per unit volume. The indices which are important are the total red cell mass, which indicates the amount of available hemoglobin, and the total amount of plasma, which indicates the volume of fluid available to transport the hemoglobin and maintain the proper circulation.

In an attempt to contribute to the understanding of these problems, we have tried to depict diagrammatically some of the various conditions found in health and disease which involve the vascular system and the blood volume.

The vascular system in health is represented in figure 1. The volume in the cylinder as determined by the height of the plunger is symbolic of the expansile and contractile properties of the vascular system, which decreases and increases the volume by changing the lumen of the vessels. The weight represents the tone of the vascular system which maintains the blood pressure. The red cells are represented by the circles and the plasma protein by the squares. The rest of the content (that is, the water, electrolyte, etc.) is represented by the background around these circles and squares. This diagram we will consider to represent the condition of a typical normal patient with the blood volume of 4500 cc., red count of 5 million and hematocrit of 45.

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Figure 2 represents the vascular system of a patient within 2 hours following a moderate hemorrhage. Time has not yet allowed an appreciable inflow of the interstitial fluids into the vascular system. Thus there is no dilution of the blood. Only the blood volume has been changed by the hemorrhage. The red count, hematocrit, and hemoglobin are essentially the same. Because of the contractile properties and tone of the vascular system, the blood pressure is being maintained.

Figure 3 represents the condition found in the vascular system within several hours following a rather large hemorrhage. Here again the blood volume has been changed, now to such an extent that it no longer fills the vascular system, which is contracted to its maximum as represented here by the plunger not even touching the top of the blood. It is to be noted that there has not yet been time for dilution of the blood in the vascular system by an inflowing of interstitial fluid; therefore, the red count, hemoglobin, and hematocrit are not significantly changed. The blood pressure is not being maintained because the blood volume is not large enough to fill the vascular bed. The patient is in shock.

Over a period of 2 to 6 hours following a hemorrhage, hemodilution begins, gradually lowering the hematocrit or hemoglobin as interstitial fluids enter the intravascular compartment. The completion of this process usually requires 12 to 36 hours in a normal, healthy, well hydrated young adult.⁴ The wide-spread changes that take place even after a minor hemorrhage are among the most delicate indices of the activity of some of the receptor-effector mechanisms which are sensitive to volume, flow, or pressure. During this period of time, there is a conservation of fluid by the body caused by a sharp increase in the water retention in the kidneys. Intracellular and extracellular sources of fluid thus join to replenish the plasma volume by refilling the capillaries as shown by the falling hematocrit. After a period of equilibrium has been reached, the patient is left with a low volume of red cells, a high volume

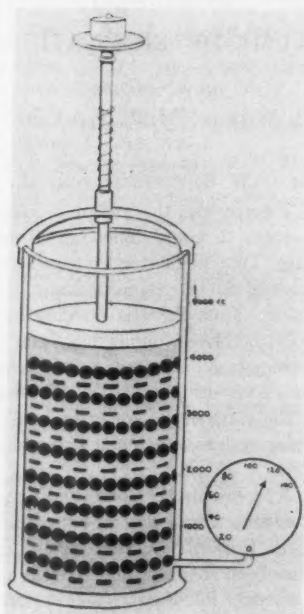


FIG. 1. Diagrammatic representation of vascular system in health. Circles represent red blood cells, squares plasma protein.

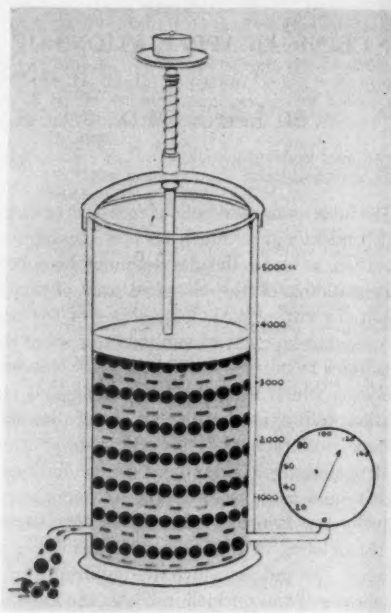


FIG. 2. Diagram showing vascular system during or immediately following moderate (1000 cc.) hemorrhage, showing no change in hematocrit or red cell count.

of plasma, *i.e.*, with a nearly normal blood volume and a stabilized secondary anemia.

In Figure 4 we see the results of the process of hemodilution, for this figure represents a condition some 6 hours following hemorrhage. Here are some, but not all, of the changes one would expect in the hematocrit, hemoglobin, and red cell determination. Figure 5 represents the vascular system some 24 to 36 hours following severe hemorrhage, when equilibrium has been established. Only here do we see the full extent of hemodilution. This illustrates a hemorrhage which was not treated by transfusion, but by the inflow of interstitial fluids into the intravascular space and/or by the administration of intravenous plasma, plasma expanders, or electrolyte solution. This illustration should emphasize the fallacy of using hemoglobin, hematocrit, and red cell count to judge the amount of hemorrhage until after a long lag period has passed. Only by blood volume determinations can the actual status of the vascular system be realized. The extent of hemorrhage may be grossly and even dangerously underestimated if the hemoglobin, hematocrit, or red cell count are used as criteria without including blood volume determination.

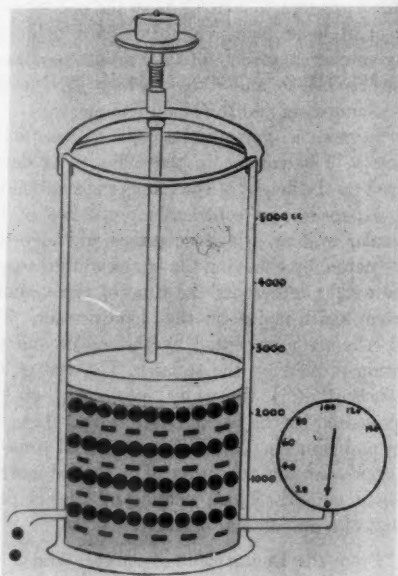


FIG. 3. Vascular system after large hemorrhage (50 per cent); patient in shock, with blood not filling vascular space which is contracted all the way down. There is no hemodilution seen.

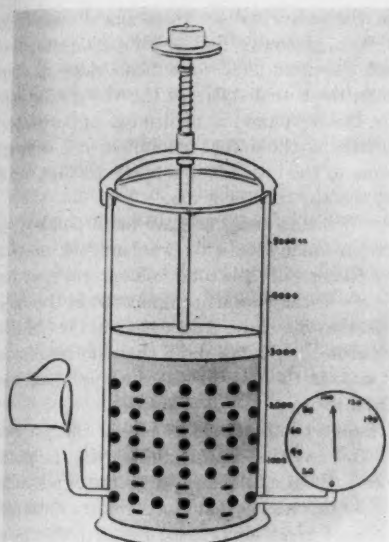


FIG. 4. Hemodilution beginning with falling hematocrit and red cell count.

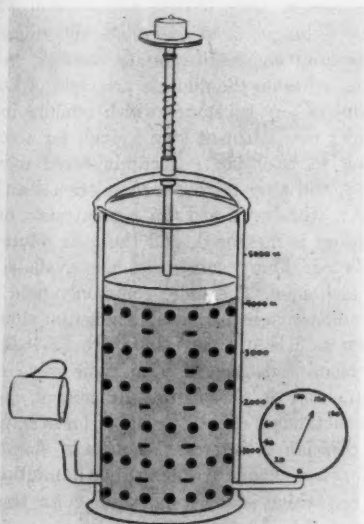


FIG. 5. Hemodilution complete some 24 to 36 hr. after hemorrhage.

For the same reason, the indications as to when a patient has stopped bleeding may be in error when these indices alone are used. The usual methods of estimating blood loss during the operative procedures,⁷ namely, pulse rate, blood pressure, venous pressure, analysis and weight of

sponges, or weight of patient, have not completely answered the problem satisfactorily. The pulse rate, blood pressure, or venous pressure⁹ may change due to blood loss during operation, but their change may also be due to the effects of anesthesia. The evaporation of fluids, particularly during long cases, may cause inaccuracies in the weighing of sponges. The third space shift may cause error in using the weight change of the patient as an indication of change in blood volume. The blood volume determinations are immune to these fallacies and are the most accurate and easiest way of determining blood loss.

A small blood volume is to be expected with acute or chronic blood loss; however, it is not uncommon also to find severe blood volume deficits in patients with prolonged illnesses.² Figure 6 shows what we would theoretically assume to be the situation in the individual with chronic illness who, for reasons either pathologic or dietary, has not been able to build red cells or plasma protein. We would assume that the blood volume is normal, that there is some anemia and some decrease in plasma protein; but what truly happens is that the body is able to compensate in a marvelous way for the deficiencies by concen-

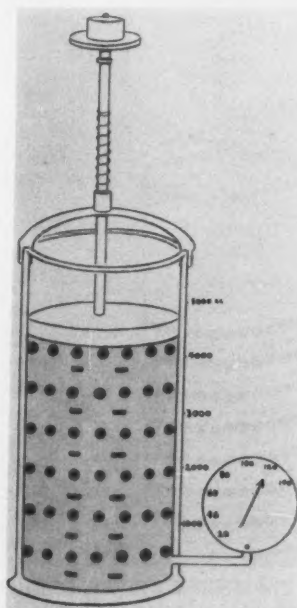


FIG. 6. Chronic anemia but normal blood volume—the picture one might suppose would be found in the chronically sick patient.

trating the red cells and proteins to a smaller volume of fluid, thus returning them to near normal levels as shown in figure 7. If we were, in this individual, to use the hematocrit and red count or hemoglobin to determine his fitness for surgery, then by all means, we would say that he is in fairly good shape preoperatively. This is not the true picture. For here the total volume is decreased. While the patient is doing well in this compensated condition, the trauma and blood loss for which he can further compensate is decreased. Thus he has an added risk which without blood volume determination would not be foreseen. This is what we have chosen to term the chronic decreased blood volume. This is just opposite to the increased blood volume found in hyponatremic starvation as described by Moore.⁵ In this situation there is an increase not only in the interstitial fluid but also in the intravascular volume, caused by an increase in the amount of plasma present. There is no index which will show this variation except blood volume determinations and without them these patients can easily be overtransfused.

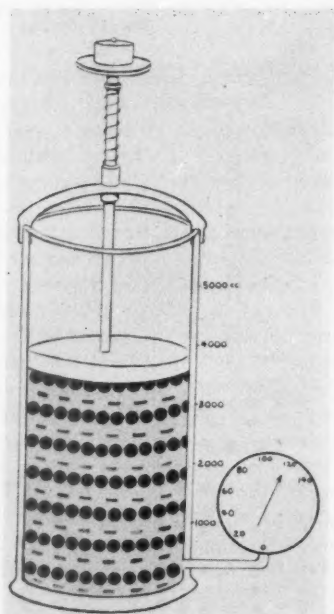


FIG. 7. The chronically ill patient may at times concentrate the blood volume and bring the hematocrit and hemoglobin to within normal limits as shown here, yet have decreased blood volume.

In the individual to whom blood transfusion has been given we find a complex problem in which the usual indices are of no value in determining the actual status of the vascular system. Here blood volume is of utmost importance in determining the actual amount of red cells and plasma in the intravascular space so that intelligent therapy may be given.

As Williams and Parsons¹² have pointed out, there are many patients who may or may not have changes in their total volume, yet may have changes in the various components of the blood. Thus, they may have a deficiency in the red blood cells or in the plasma and if these deficiencies are not known, the transfusion of whole blood alone will be wrong.

The most important fact is that there appears to be no way that we can guess what the patient needs without actual measurements of all factors. It is for this reason that blood volume determination is of great importance for all patients who undergo major surgery, and is of the greatest importance to those patients in the extremes of age or those who have had a serious chronic or acute disease.

The technique of blood volume determination varies from one institution to another, but in general relies on the dilution principle. A known amount of any substance which remains in the vascular compartment long enough for accurate mixing to take place is administered intravenously, and after mixing is complete a sample of blood is withdrawn and the concentration of the substance is measured, and thus the dilution is calculated. Many substances are available for this technique. The more commonly used ones are radioactive iodinated human serum albumin, known as RISA, Evan's blue dye (T-1824), or red blood cells tagged with radioactive chromium, iron, or phosphorus. In general, any of these methods is clinically reliable, for in actuality the clinician is interested not in a few cubic centimeters change in volume, but in multiples of 500 cc., which is the usual volume for transfusions. As Moore⁵ has pointed out, we are interested in changes over 10-15 per cent, for the body compensates very well for changes of this extent.

In the treatment of the patient in some emergency situation or in the treatment of the patient who has been chronically ill, it becomes imperative to have a fairly accurate method of assigning a normal blood volume to a given individual. It

is obvious that unless we know the ideal or normal volume in a certain individual, the measurement of the actual volume will be of little use in deciding what therapy, if any, is indicated. Unless we know whether a patient has a decrease or an increase in a certain component, certainly we cannot correct his abnormality.

Many methods of calculation of the normal have been suggested, and acceptable deviations from the norm have varied from 5-30 per cent. This seems too great for clinical application. It was felt that since the body can very well tolerate a change of 10-15 per cent of blood volume without serious difficulty that this would have to be the outer limit of variation. We therefore felt that in general the limit of 500 cc. could be conveniently set up as confidence limit. To test the variously described methods of estimating "normal," the blood volumes of 92 healthy volunteers between the ages of 18 and 45 years of age were measured by the RISA dilution method. We were quite aware that the RISA method is not quite as reliable as the method using red cells tagged with chromic-51,¹¹ but the RISA method has proved very useful in our hands for the following reasons: (1) It is relatively cheaper. (2) It is more easily handled.

(3) It utilizes less radiation and thus gives to the patient less body radiation. (4) It is subject to fewer technical errors in the actual mechanics of determination. The results obtained on these volunteers were then plotted against the various physical constants which could be measured in even the acutely ill. Figure 8 shows the scattergram developed when the blood volumes were plotted as abscissa and the female volunteers' weights were plotted as ordinate. It is obvious that there is too great a variation in volume in individuals of the same weight, so that in no manner could an adequate confidence limit be established.

When the method of Perry⁸ was used in correcting the weight for height as shown in figure 9, where the corrected weight is plotted as ordinate and the red cell mass was plotted as abscissa, there is again noted too great a range of volume on the scattergram to make this a clinically acceptable method among our volunteers.

It was postulated that since the muscles contained some six times the amount of blood as fat, the ideal weight would have to be varied by either adding one sixth of the amount that the volunteer was overweight, or subtracting one sixth of the amount if the volunteer was under-

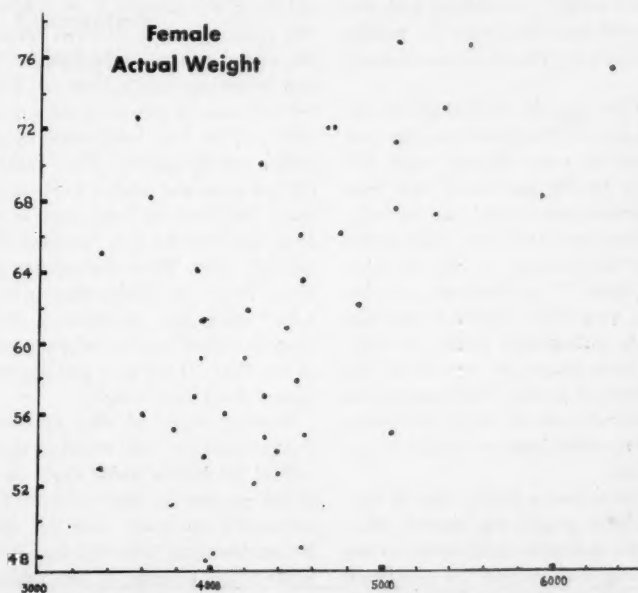


FIG. 8. Actual weight of female volunteers in kilograms plotted as ordinate and blood volume plotted in cubic centimeters as abscissa.

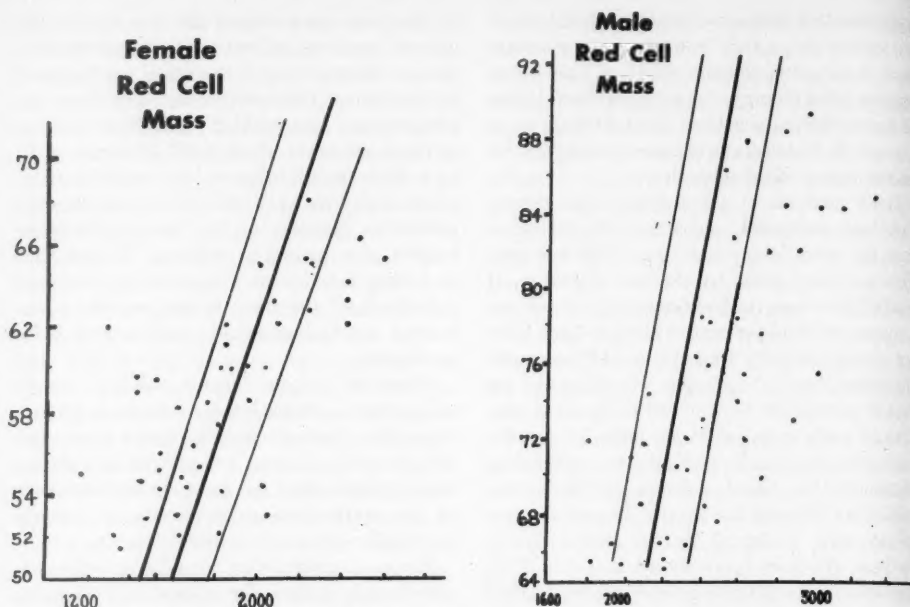


FIG. 9. Plots of male and female volunteers using weight corrected according to Perry as ordinate and red cell mass as abscissa.

weight. Scattergrams (fig. 10) made when plotting this corrected weight as ordinate and the blood volume as abscissa show that the results are spread far outside the 10 per cent confidence limits.

Baker¹ pointed out that the ratio of the blood-rich muscle and skin to the blood-poor fat and bone is correlated in some manner with the metabolic activity in the individual, and that since the body surface area is used as a basis for calculating the basal metabolic rate, this might serve as the basis for plotting. A plot was then made, shown in figure 11, in which the volumes of the volunteers were again plotted as abscissa against their body surface area plotted as ordinate. Obviously these figures are not within the 10 per cent confidence limits. This corresponds rather well to Baker's work in which he reports only 89 of 150 of his volunteers are within 11 per cent of his base line.

It became obvious that a better way of estimating the lean body weight was needed. Muldowney⁶ has shown a definite relationship of the red cell mass to lean body weight. He calculated the lean body mass by the Pace-Rathbun formula and the Keys-Brozek formula using the body's specific gravity, the antipyrine and the thio-

cianate space measurement. In plotting the red cell mass, the formula $Y = (32.74)(X) + 155.7$ was obtained. This formula gave a regression line of red cell mass which fell within the 5 per cent confidence limits. Huff and Feller³ measured red cell mass by means of chromic-51 labeled red cells and the lean body mass by measuring the body's specific gravity. They concluded that the red cell mass was related to fat as well as to lean tissue and that fat body mass is no better than total body weight as a standard of reference for red cell mass. Their findings are different from those found by Muldowney who, in rebuttal, stated that this discrepancy shows that the equation is not valid in subjects with fat content of less than 10 per cent and greater than 25 per cent of total body weight.

Another source of error apparently is in the sequestered red cells found in the splanchnic as well as the splenic areas which do not take part in the circulating blood volume. Prentice *et al.*¹⁰ attempted to show this by giving patients hexamethonium, believing that if stagnant areas existed, the opening of the arterioles with the increased flow caused by this drug would improve the circulation through these areas and bring about a more complete mixing, thereby including

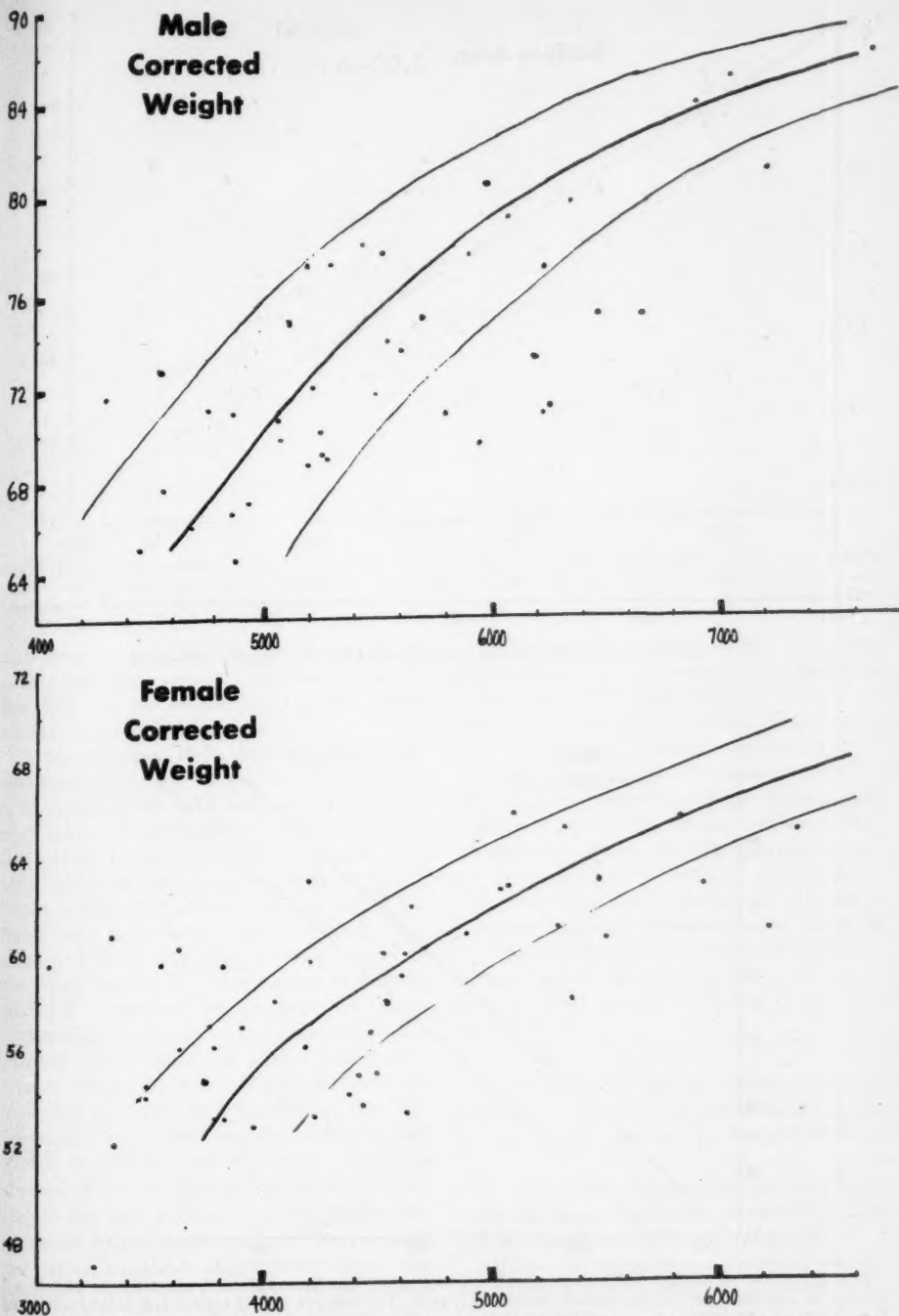


FIG. 10. Corrected weight for male and female plotted as ordinate and blood volume as abscissa. Median line drawn in with 10 per cent confidence limit indicated.

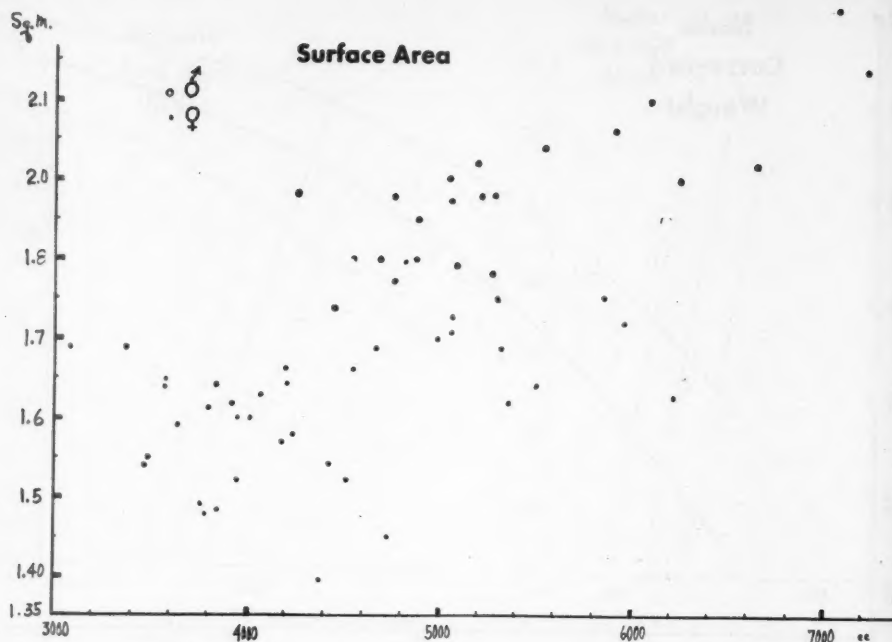
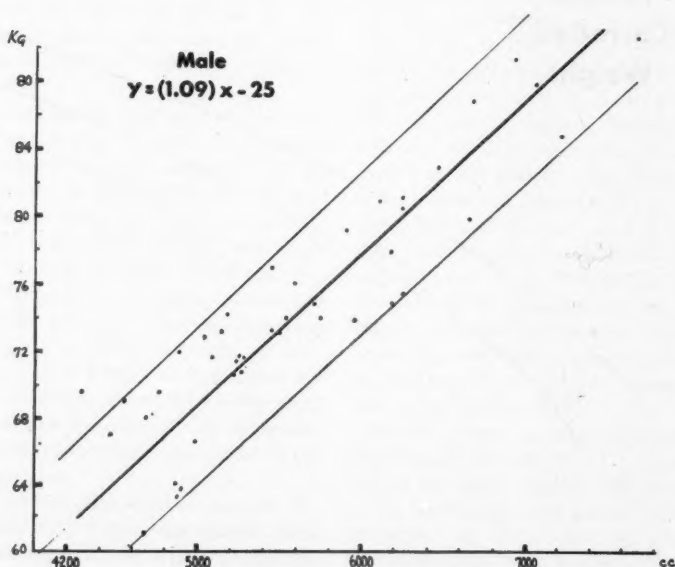


FIG. 11. Surface area plotted as ordinate and blood volume as abscissa

FIG. 12. Male volunteer weight calculated according to size frame plotted as ordinate and blood volume as abscissa. 500 cc. confidence limits indicated. The median line is translated algebraically as $Y = [(1.09)(X) - 25][100]$.

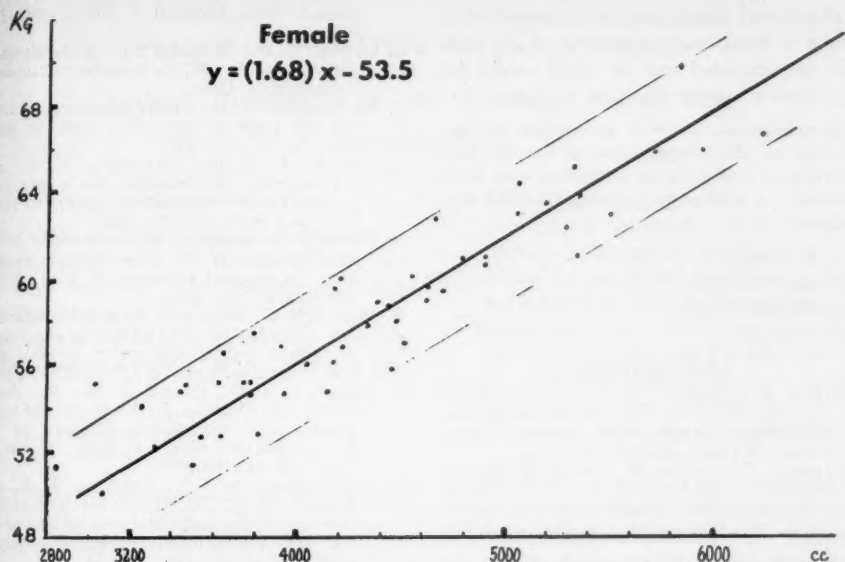


FIG. 13. Volunteer female weight calculated according to frame plotted as ordinate and blood volume plotted as abscissa. The 500 cc. confidence limits are outlined. The median line when translated algebraically is $Y = [(1.68)(X) - 53.5][100]$.

these areas in the circulating blood volume. In none of their trials were they able to demonstrate this; however, the assumption that this sequestration exists is still a valid one.

In the volunteer, these methods (that is, the calculation of the specific gravity by submersion or by measuring the total body water) seemingly work very well, but neither can be used in the sick patient. It was postulated that since the lean body weight is only roughly correlated to the height-weight, if an estimate of the size of the frame and muscularity could be made, this could lead to an estimation of some parallel to lean body weight. This assumption apparently has led to a solution of this problem. The Metropolitan Life Insurance Company has published a chart of ideal weights and heights according to type of frame. Another scattergram was made using this table with the data obtained from the volunteers with their corrected ideal weight plotted as ordinate and the blood volume as abscissa. Figure 12 shows that all but 5.4 per cent of the male volunteers' blood volumes lay within the 500 cc. confidence limit. The regression line when translated algebraically gives the formula $Y = [(1.09)(X) - 25][100]$ when Y is the blood volume and X is the weight in kilo-

grams corrected according to the above mentioned tables. The ideal weight was used in the underweight individuals, while one third of the amount of overweight was added to the ideal in those volunteers who were overweight. Figure 13 shows the values of the female when plotted in this same manner. Only 4.4 per cent of these values lay outside the 500 cc. confidence limit. The regression line can be translated algebraically into the formula $Y = [(1.68)(X) - 53.5][100]$.

In translating these formulas to patients we have been very well pleased with the results, for in every instance they have coincided with the clinical course and replacement according to these principles has led to clinical correction of the deficiency.

SUMMARY

1. Accurate blood volume determinations are necessary if the actual severity of blood loss is to be known within the first few hours of its occurrence.

2. Hemoglobin, hematocrit, and red blood count do not give accurate estimates of blood loss for many hours following hemorrhage.

3. Blood volume alone can accurately identify the chronically decreased or increased blood volume patients.

4. Ideal blood volumes can be calculated when the type of frame and muscularity of the individual are estimated and the ideal weight for these frames is used in these new formulas.

Acknowledgment. We wish to express our appreciation to Mrs. Peggy Howard for her long hours of work and patience in dealing with these volunteers, as well as for her many helpful suggestions.

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VALUE OF OPERATIVE CHOLANGIOGRAPHY

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INTRODUCTION

The value of operative cholangiography in the surgical management of biliary diseases and conditions continues to be a controversial subject. There are a number of advantages and disadvantages in the use of this procedure. A review of our experience over a 10-year period is presented.

OPERATIVE CHOLANGIOGRAPHIC TECHNIQUE

In order to obtain the maximum benefits from this procedure and to insure a high percentage of satisfactory films of the biliary tree, absolute cooperation is essential between the surgeon, radiologist, x-ray technician and anesthetist. The following equipment is required:

1. Plywood tunnel able to take up to size 14 by 17-inch cassette. A four-in-one polygraph is used in order to obtain rapid multiple exposures.
2. Three 10 by 12- or 14 by 17-inch film cassettes.
3. Lysholm grid (portable Buckey may replace tunnel and grid).
4. Portable x-ray unit or an overhead built-in x-ray unit.
5. Twenty-five cubic centimeters of 35 per cent Diodrast.
6. A 22-gauge, $\frac{1}{4}$ -inch needle or 18-gauge, $1\frac{1}{2}$ -inch needle; straight intravenous cannula attached to 12-inch length of amber rubber tubing.
7. Two 30 cc. syringes and adapters.

TECHNIQUE

1. Patient placed upon operating table supine, with a 5 to 10° right posterior oblique position, with plywood tunnel centered over the gall bladder region, with cassette in place.
2. Sterile drapes and wound towels sewed in place to avoid appearance of instruments in x-ray film overlying biliary anatomy.

From the Department of Surgery, Veterans Administration Hospital, Des Moines, Iowa.

3. After dissection of junction of cystic and common bile ducts, the cystic duct is occluded. A 22-gauge, $\frac{1}{4}$ -inch needle connected by an amber tubing to a 30 cc. syringe full of sterile saline solution is inserted into the common duct toward the liver. If a cannula is used, it is inserted into the cystic duct. Position of needle is tested by injection of saline solution.
4. Five cc. of 35 per cent Diodrast is injected slowly.
5. At the count of five, the anesthetist suspends respiration in inspiration and signals the technician to make the x-ray exposure.
6. One- to three-second x-ray exposure is made with a setting of 90 KVP and 30 MA.
7. Two additional injections of 5 cc. each are made in a similar manner. Keep air bubbles out of the apparatus and biliary system.
8. Films are processed and returned to the operating room for interpretation.

ADVANTAGES

1. Permits immediate visualization and evaluation of the intra- and extrahepatic biliary ducts.
2. Enables immediate determination of the site and type of pathology:
 - (a) Common duct calculi and calculi elsewhere in the bile ducts.
 - (b) Pancreatitis.
 - (c) Spasm or stricture of sphincter of Oddi.
 - (d) Stricture or stenosis of biliary tree.
 - (e) Tumors of head of the pancreas or biliary tree.
3. May prevent unnecessary surgery.

DISADVANTAGES

1. False-positive findings in about 6 per cent of cases.
2. Presence of air bubbles occasionally in biliary tree introduced during cholangiography. This interferes with accurate interpretation of films.



FIG. 1. Cholangiography through T-tube. Biliary tree dilated due to impacted stone (rarified circular defect) at ampulla of Vater.



FIG. 2. Common channel of pancreatic and common bile duct entering ampulla of Vater



FIG. 3. Multiple stones in common bile duct with markedly dilated biliary tree



FIG. 4. Impacted stone in ampulla of Vater; markedly dilated biliary tree; common opening of primary pancreatic duct and common bile duct into ampulla of Vater.



FIG. 5. Direct cholangiogram by needle technique reveals strictured obstruction of common bile duct at point of junction of right and left hepatic ducts.

FIG.
bile d



FIG. 6. T-tube cholangiography, postoperatively in same case as fig. 5 after anastomosing of common bile duct to duodenum. Biliary tree almost normal in diameter.

3. Delay in carrying out operative procedure—wait for processing of films, etc.
4. Hazard of wound contamination from mechanical sources and other measures required for taking of x-ray pictures.

PROCEDURES PERFORMED

During a 10-year period from 1948 to 1958, 628 surgical procedures were performed upon the biliary tree. Of this number, 483 were cholecystectomies. Cholangiograms were performed in about 15 per cent of the cases in this series (table 1).

The patients who had cholangiographic studies ranged in age from 24 to 78 years. However, 59 per cent occurred in the 50 to 69 year age groups (table 2). The average age was 54 years.

In 37 cases the cholangiograms performed were of the immediate type, whereas in 30 cases the technique was employed as the delayed type—that is, sometime during the postoperative period.

RESULTS

In 56 cases the x-rays were considered satisfactory for accurate interpretation, whereas in 11, or 16 per cent, they were deemed unsatisfactory.

TABLE 1

Operative procedures

Procedure	No. of Cases
Cholecystectomy.....	483
Cholecystostomy.....	29
Common duct exploration.....	88
Other.....	28
Total.....	628
Cholangiograms.....	67

TABLE 2

Age incidence of patients with cholangiographic studies

Age	No. of Cases	Percentage
20-29	4	6
30-39	8	12
40-49	12	18
50-59	16	25
60-69	22	34
70 or over	3	5
Total.....	65	100

In 64 per cent of the cases, the cholangiographic findings were normal and in only 36 per cent were calculi or other pathologic conditions detected. Of the abnormal group the presence of stones was the most frequent finding (table 3).

In 6 per cent of the cholangiographic studies, false-negatives were reported in which stones that were present and demonstrated at the time

TABLE 3

Cholangiographic findings

Condition	No. of Cases
Calculi.....	8
Ampullary obstruction.....	2
Calculus.....	1
Dilated ducts with stone.....	1
Air bubbles.....	1
Biliary fistula.....	1
Total.....	14

TABLE 4

Postoperative complications

Type of Complication	No. of Cases
Wound	
Dehiscence.....	1
Granuloma, silk.....	1
Hematoma.....	1
Incisional hernia.....	2
Infection.....	1
Painful.....	1
Seroma.....	1
Total.....	8
Pulmonary	
Atelectasis.....	2
Bronchopneumonia.....	1
Embolism.....	1
Pneumonitis.....	1
Pneumothorax.....	1
Total.....	6
Miscellaneous	
Biliary dysphagia.....	1
Fever.....	1
Peritonitis.....	1
Urticaria.....	1
Total.....	4
Total.....	18

of the first or second operation were not visualized on the cholangiograms.

COMPLICATIONS

There were no systemic or local complications attributable to direct cholangiography. The postoperative complications that occurred in this series of 628 cases are listed in table 4. Sixteen patients (3.1 per cent) developed 18 complications.

DEATHS

There was one postoperative death, (0.2 per cent) which occurred on the 13th postoperative day. It was due to bile peritonitis. Cholangiography was not performed upon this patient.

COMMENT

It is apparent from our report that we do not employ direct cholangiography as a routine procedure for patients undergoing surgery for biliary tract diseases or conditions. On only 15 per cent of this group was this technique employed.

For 6 per cent of the total number of patients on whom cholangiograms were obtained, a false-negative report was obtained. In 16 per cent, the films were considered unsatisfactory for accurate interpretation.

We continue to utilize this adjunctive procedure on those patients for whom exploration of the ductal system appears indicated and the underlying pathology or cause of obstruction is

not certain. In addition, it is employed occasionally on those patients in whom we suspect a biliary calculus or calculi may be overlooked during exploration of the common duct.

This method is valuable during the postoperative period for those patients with a T-tube in their common bile duct. The evaluation of the biliary tree by this method of direct visualization is a potent aid in deciding the optimum time for removal of the T-tube as well as in providing current information concerning the size of the ductal system and patency and functional status of the ampulla.

SUMMARY

Direct operative cholangiography is a valuable adjunctive diagnostic procedure when applied to certain problems facing the surgeon during biliary tract surgery. In some patients it may avoid an unnecessary common duct exploration and in others it may aid in visualizing a biliary calculus or calculi not palpable or visible during common duct exploration.

The employment of this method as a routine procedure is not considered advisable. In order to obtain the maximal benefit of this visual aid, proper application of the refinements in technique and cooperation of the anesthetist and radiologist are essential.

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THE USE OF HYPNOTIC ANESTHESIA FOR MAJOR SURGICAL PROCEDURE

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Anesthesia may be said to be the loss of sensation, with or without the loss of consciousness, that may be caused by disease, injury, or chemical agents. To this list of causes should also be added hypnosis or suggestion. Before the discovery of ether and chloroform, the first attempt to perform surgery with the patient under mesmeric (hypnotic) anesthesia was made by Dupotet and Racamier in 1821. Oudet described the extraction of teeth under magnetic sleep in 1837. John Elliotson, an English surgeon, published in 1843, a book "Numerous Cases of Surgical Operations without Pain in the Mesmeric State." He continued publishing in "The Zoist" other cases of surgical procedures under mesmeric anesthesia which he collected from all countries of the world.

On April 4, 1845, James Esdaile performed, in his native hospital in India, his first operation during which the patient was under the influence of hypnotic anesthesia. Before leaving India, Esdaile performed thousands of painless operations, about 300 of which were major, 19 being amputations. His contribution came at a time when there were no chemical anesthetics, and his mortality rate was 50 per cent lower than those of the other surgeons who were performing the same operative procedures. Esdaile asserted that during the operations his patients not only remained quiet, but failed to show the ordinary physiologic signs of pain such as changes in the pulse, dilatation of the pupils, and increase in the respiratory rate, which are characteristic of operations in the nonhypnotic state. The discovery of chloroform and ether occurred while Esdaile was in the midst of his surgical experiments. As a result, this phase of hypnosis which might have otherwise seen a great development was destined to become little more than a scientific curiosity.⁶

The literature abounds with references to major and minor surgical procedures carried out under hypnoanesthesia alone.^{3 4 11 15 16 17 19}

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Raginsky²⁰ and Marmer¹⁶ suggest the use of hypnotic suggestion in combination with a chemical anesthetic agent; however, anesthesiologists have been active in seeking more efficient anesthetic agents for the relief of pain. The use of hypnotic anesthesia closely approaches the criteria listed for a perfect anesthetic agent. It is not practical to substitute hypnotic anesthesia for chemicals in every operative case, but there are many patients who prefer this method to the psychologic trauma caused by chemical agents.

Hypnosis may be defined as an artificially induced state characterized by greatly heightened suggestibility to the hypnotist. The state is usually attained by bodily relaxation accompanied by attention, at the suggestion of the hypnotist, to a narrow range of objects or ideas. A person under hypnosis shows extreme responsiveness to any suggestion made by the hypnotist.⁵ It is assumed in hypnosis that the patient's needs, motivations, relevant dynamics and transference relationships have been sufficiently understood, that there are adequate indications for the employment of hypnosis and no serious contraindications to its use, that the plan of procedure (with regard to anamnestic investigations, cathartic recall, symptomatic or posthypnotic suggestions, and so forth) has been worked out as specifically as possible. Even so, it is usually advisable to make sure that the patient clearly understands that hypnosis is merely a form of relaxation, that it does not entail surrender of control or responsibility, that it does not make the subject vulnerable to any thoughts or acts contrary to his desires, and that it is being conducted for scientific purposes only.¹⁸

The patient's motivation, his ability to accept an idea uncritically, and his need to rely on the prestige of the doctor are of inestimable value in any form of healing. This is especially important for the induction of deep hypnosis. When one wishes to perform major surgery under hypnoanesthesia, it is very important to get the patient to believe the actuality of the trance state, and if

this belief is strengthened by the doctor's self-assurance, the likelihood of a successful outcome is increased.¹² The patient must be set to accept his physician-hypnotist's words as valid descriptions of reality. The physician-hypnotist must manipulate his words and the situations in such a way as to lead the subject to believe that the suggestions are literally true statements. These suggestions should be accepted without criticism or analysis. Every patient during the preparatory hypnotic inductions and sessions must be led to experience the operation with all details. With this preparation the patient is protected against any possibility of surprise, fright, and terror.²²

Marmer¹⁴ states that many emotional changes accompany anesthesia, and it is well known that stress may produce hypertension, tachycardia, or irregularities of cardiac rhythm. Although every person handles anxiety in his own fashion, the correct psychologic approach on the part of the anesthesiologist will go a long way toward obviating psychic trauma and establishing confidence. The usual method of chemical anesthesia requires only a moment or two or reassurance before the anesthetic is started. In the use of hypnoanesthesia, a relatively longer discussion preliminary to the induction is prerequisite.

The patients who desire surgery under hypnoanesthesia must have an intense desire to go through with the procedure. Hypnoanesthesia has been a controversial subject as to its mode of action. It is difficult to say whether painful stimuli to the brain are actually blocked off, or whether the very painful and prolonged stimuli may not produce verbal complaints, facial flinch, withdrawal of part, or changes in respiration only because these functions are at least partially voluntary. Reaction to pain is, among other things, a function of the attitude of the patient. Pain must be considered from both the physiologic and the psychologic approach. Pain is a perception and is subject to the influence of associated ideas, apperceptions and fears. Experimentation has shown that the autonomic processes which are characteristic of pain are greatly reduced when the individual is exhibiting hypnotic anesthesia. Electromyographic studies indicate that pain is perceived in the tissues, but during deep hypnosis, noxious stimuli do not reach the pain receptors in the higher brain centers. This probably occurs as the result of "synaptic ablation" (the synapses remain open) in the spinal

cord. Apparently the higher cortical centers are not stimulated during deep hypnosis. Hence the vegetative nervous system is able to maintain homeostasis and thus raise the adaptive response of the organism to stress.¹¹

Crasileck and associates⁴ have cited special indications for hypnoanesthesia. Hypnoanesthesia is (1) indicated in cases in which chemical analgesics and depressants are contraindicated or dangerous because of respiratory or cardiac disease, (2) used in cases in which the repeated use of anesthetics tends to have a debilitating effect on the patient with an already disturbed physiology, (3) utilized as the preferred anesthetic of choice because of sensitivity of the patient to chemical anesthetic agents, (4) indicated in patients whose apprehension and fear of general anesthesia are so great as to interfere with its smooth application or even to result in serious anesthetic risks, (5) utilized for patients in whom it is desirable to free some of the neurophysiologic effects of the anesthetic.

Since hypnosis is a quantitative term referring to the relative degree of receptivity to suggestion or command, and has no demonstrable qualitative characteristics, statistics as to what proportion of the population "can be hypnotized" are almost meaningless. Almost all the standard text books on hypnosis^{8, 13, 21, 23} give the following percentages of susceptibility to hypnosis: 85 to 90 per cent of all adolescents and adults can be hypnotized; 25 per cent enter the light trance state; 35 per cent enter the medium state; and 20 to 25 per cent enter into the deep or somnambulistic state. It is in the deep or somnambulistic state that we are interested in hypnoanesthesia. Most normal people can be trained to develop hypnotic anesthesia, but certainly in some people this requires a great deal of training. We are dealing with a psychologic technique which involves the total personality of the patient. Hypnosis becomes an especially intense transference interrelationship. The confidence of the patient in his ability to achieve success and a normal period of conditioning by a trained physician-hypnotist assure the surgical team of probable success in the operative procedure. Success also depends on the patient and his attitudes toward the approaching surgery. There is no set amount of time for the conditioning of these patients. Techniques are chosen to suit the individual needs of the patient.

At the first session, the advantages for that patient of the use of hypnoanesthesia in surgery are discussed. Hypnosis is thoroughly investigated with the patient so that apprehension and fears may be removed. Many fear the word "hypnosis" because of previous knowledge and exposure to the subject through stage and amusement performances. Many fear the mystery that has been built up throughout the years because of the wrong explanation of the subject. Hypnosis is a conscious state. It is a voluntary, consent state, and the patient is not subject to the will of the physician-hypnotist. The patient is next conditioned and taken to as deep a state of relaxation as is possible. At times there is difficulty and uncertainty in producing the necessary degree of hypnosis. There are some individuals whose personality make-up is such that it is not wise to increase the transference relationship between patient and anesthesiologist. Raginsky²⁰ states that the average anesthesiologist has had very little training in the psychodynamics of personality. Such training is essential if one is to be successful with and make proper use of hypnosis, since it is primarily a human situation involving a delicate interplay of human strivings.

Posthypnotic suggestions are then given to the patient to suit the individual needs of each type of operation. Suggestions may be given to the effect that the patient will not feel any pain (hypnotic anesthesia). The second application may be to suggest to the patient that no stimulus, no matter how intense or strong, will probably disturb him. The first suggestion acts to create a loss of sensory perception. The latter creates loss of pain perception. Suggestions are also given to produce sedation before and after surgery. These are effective in lessening the incidences of postoperative atelectasis because suggestion helps the patient to breathe deeply and cough without discomfort if necessary. Hypnosis also is effective in producing operative amnesia and improving postoperative morale and motivations toward getting well.¹⁶

In the following sessions, greater depth of hypnosis is secured, and the posthypnotic suggestions are reinforced. While the patient is in the hypnotic trance, the entire operative procedure is explained to him so that he may be familiar with each step that will occur, and so that at no time will he be threatened with the element of surprise. He is tested for anesthesia over the operative site, and also reinforced through posthypnotic sugges-

tion for maintenance of anesthesia throughout the entire operative procedure. There is the possibility that the patient may be such a good somnambule that the depth of hypnosis approaches that of a stuporous or "coma" state. If this occurs, the patient will not take suggestions, but will suggest anesthesia over the entire body through his own volition. These patients constitute a very small percentage of the general population. Dissociation techniques may also be used as a means of raising the pain threshold. Björnstrom² suggests giving posthypnotic suggestions for anesthesia while the patient is in physiologic sleep.

The use of hypnotic techniques will reduce toxicity and lessen the dangers of cardiovascular and cardiorespiratory depression. Hypnoanesthesia offers the greatest benefit and advantages to the patient. There is no loss of reflexes under hypnotic anesthesia as there is with deeper planes of surgical anesthesia. There is no need for narcotics for the patient in the postoperative period, since there are no complaints of pain at the operative site, and the ability of the patient to move around and help himself further enables a more rapid postoperative recovery. Raginsky²⁰ states that the evidence of shock and postoperative discomfort may be masked by the posthypnotic suggestion. Although the patient may have no memory of pain following any of the procedures, when re-hypnotized at a later date, he can usually recall the site of pain and describe accurately the pain experienced at the time of operation. Any amnesia present is the result of suggestion and not due to the lack of sensation. This is not the case where chemoanesthesia is used.

In the cases of total hypnosis for the surgical procedures performed by the author, plans are set up for the recall of all of the patients, re-hypnotization and recall of the operative procedure while an electroencephalogram is being done. This will demonstrate whether pain was actually perceived although no outward signs of discomfort were visible, or whether the suggestions created a total loss of sensory perception.

The following surgical procedures were done with total hypnosis and with no anesthetic agents being used: (1) debridement of burns and skin grafts, (2) vaginal hysterectomy, (3) bilateral vein ligation and stripping, (4) cesarean section, (5) appendectomy, (6) hemorrhoidectomy, (7) open-heart surgery for closure of an atrial septal defect.

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All the above patients had definite indication for hypnotic anesthesia, and all proved to be excellent subjects. An average of five to six sessions, each lasting about 30 minutes, was necessary to condition the patients properly for their surgical procedure. At no time was there any doubt in the minds of all the patients that the operative procedure under hypnoanesthesia would be successful. Actually, the surgeons were rather skeptical about the results that would be obtained; however, they were willing to proceed, because of the assurances of the patient and the physician-hypnotist. Instructions should be given to the surgeon as well as to the operating suite personnel, in semantics, or choice of words. Noise should be kept to a minimum, and extraneous talking and laughter should be discouraged. Since hypnoanesthesia is a medical curiosity, there is a tendency to overcrowd the operating suite, and since the patient under hypnosis has increased awareness, this practice should likewise be discouraged.

CASE REPORTS

Case 1. A 21-year-old female entered the hospital for an elective cesarean section. She had poliomyelitis at the age of three and had residual deformity of atrophy of both legs, scoliosis and kyphosis. Her vital capacity was reduced due to deformity of the thoracic cage. A spinal fusion had been performed at the age of 8. There was on x-ray, evidence of fetopelvic disproportion. She was conditioned for surgery at three sessions, a week apart. Posthypnotic suggestion in deep somnambulism was given. Glove anesthesia was obtained at the first session, and then transferred to the abdomen. Skin testing with a towel clip showed complete anesthesia with no reaction on the part of the patient. Preoperative sedation consisted of Seconal, gr. $1\frac{1}{2}$ the night before surgery, atropine sulfate, gr. $\frac{1}{100}$, and Thorazine, 50 mg., 45 min. before surgery. Deep somnambulism was obtained by the cue method when the patient was placed on the operating table. Reinforcement of hypnotic anesthesia was accomplished and the patient delivered a male child by means of a low flap cesarean section. Pulse and respiration remained within the normal range. Blood pressure rose 10 mm. immediately after the incision was made. It then returned to normal and remained normal throughout the rest of the procedure. Posthypnotic suggestion for discomfort following surgery was given, and the patient received 25 mg. of Sparine on two separate occasions the afternoon of surgery. Postoperative

recovery was uneventful, and the patient was discharged on the 5th postoperative day.

Case 2. A 54-year-old female entered the hospital for bilateral vein ligation and stripping. She was allergic to barbiturates and was very emotional and apprehensive. She had a mild to moderate hypertension. She was anxious to have the procedure performed under total hypnosis. Four preoperative sessions were given and the patient proved to be an excellent subject. She was able to enter into a deep somnambulist state, and accepted suggestions for anesthesia readily. Skin tests revealed complete absence of pain. There was no reaction to pain while in the hypnotic state. No preoperative sedation was given to the patient, and she was placed in deep hypnosis after entering the operating room. She was dissociated and told to ride an escalator down into a basement throughout the entire procedure. Bilateral inguinal incisions were made and ligation of the saphenous vein was done. Bilateral stripping was done, and numerous small varices were ligated at various points of the legs. A small tumor was also excised on the medial aspect of the left leg. The patient got out of bed and walked the afternoon following surgery and had no discomfort in her postoperative period. No narcotics were necessary. The patient was discharged from the hospital in 7 days.

Case 3. A 27-year-old female had hypnotherapy for migraine headaches. She developed an uncontrolled menorrhagia and had a prolapse of the uterus. Two sessions were necessary to produce hypnoanesthesia through suggestion. Skin testing revealed complete anesthesia of the lower portion of the body. Previous experience with saddle block anesthesia for delivery of her children aided considerably in establishing the loss of sensation. A vaginal hysterectomy was performed under total hypnoanesthesia. Preoperative sedation consisted of Seconal, gr. $1\frac{1}{2}$. Blood pressure and pulse were normal throughout the entire operative procedure. Posthypnotic suggestions for relief of discomfort were given and no postoperative medication was necessary. The patient got out of bed postoperatively in 2 hrs. and went to the bathroom to urinate. She was discharged from the hospital on her 4th postoperative day.

Case 4. A 28-year-old male had thermal burns covering about 80 per cent of his body surface. He had second- and third-degree burns of the arms, trunk, and lower extremities, and first-degree burns of the face. He suffered from severe pain in manipulation of his extremities and movement of his body. His appetite was poor, and because of his critical condition, it was decided to use hypnosis, both for physiologic and psycho-

logic reasons. A tracheotomy was performed because of edema of the larynx and nasopharynx. After the first session, his discomfort disappeared and pain was controlled with posthypnotic suggestion. Repeated debridements and skin grafts were done with the patient under hypnoanesthesia. His general condition improved. Manipulation of his arms and legs was possible without narcotics or general anesthesia. The patient was an excellent subject and was able to enter deep somnambulism very readily. There were no complications, and he left the hospital completely recovered.

Case 5. A 27-year-old female was a previous patient for hypnotherapy. She had been conditioned to enter a deep somnambulistic state readily. She had bleeding from the rectum, and a diagnosis of internal and external hemorrhoids was made. Only one subsequent session was necessary to establish anesthesia simulating a saddle block anesthesia. Preoperative medication consisted of Phenergan, 50 mg., and atropine sulfate, gr. $\frac{1}{150}$. She was placed in the jackknife position and entered deep somnambulism by means of the cue. She was then told to imagine herself on the beach lying in the sun and listening to music float out of a nearby hotel. She was told to keep time to the music with her finger. An internal and external hemorrhoidectomy was performed and posthypnotic suggestions were given for relief of pain around the operative site. She was then returned to her room in good condition. She complained of pain high up in the rectum, which was caused by the rectal plug pressing on a fractured coccyx. Posthypnotic suggestion for relief of this pain was given, and the patient made an uneventful recovery.

Case 6. A patient was referred because of sensitivity to Novocaine, Pontocaine, and barbiturates. A diagnosis of chronic appendicitis was made. Hypnoanesthesia was decided upon as the method of choice and the patient was conditioned in three sessions. He entered a stuporous or "coma" state readily after the second session, and testing of the operative site with a towel clip elicited no response. The operative procedure was described while the patient was in a deep somnambulistic state. He entered the hospital, was reconditioned, and an appendectomy was performed through a McBurney incision. Posthypnotic suggestion for relief of postoperative pain was given while the patient was in the somnambulistic state, and he received no narcotics postoperatively. His recovery was uneventful and he left the hospital in 4 days.

Case 7. A 15-year-old female was referred for conditioning in hypnosis and the possibility of using hypnoanesthesia for open-heart surgery.

She had a heart murmur, suffered multiple pulmonary infections and became very tired after an ordinary school day. Cardiac catheterization showed the presence of an atrial septal defect of the heart. Eight sessions of 1 hr. each were necessary to prepare the patient for the operative procedure. She entered a deep somnambulistic state with ease, and suggestions for hypnoanesthesia were given. Skin testing revealed anesthesia of the operative site. She entered the hospital and two more sessions were held on successive days. Preoperative sedation consisted of phenergan, 10 mg., and Elixer Nembutal, 50 mg. Her throat was sprayed with Pontocaine, and she was then intubated. She was told to imagine she was on an escalator going downstairs into a basement. 1000 cc. of 5 per cent dextrose in water was started. Because hypnotic anesthesia was the only anesthetic used, the patient was told to open her eyes and raise her arm and fingers while on the Pemco heart-lung machine. This demonstrated the apparent safety of the machine in maintaining cerebral circulation while on the pump. Immediate consciousness at the termination of the procedure showed no complications from the operation. The heart was open 14 mins., and she was on the heart-lung machine for 29 mins. Posthypnotic suggestions for turning, deep breaths, and coughing in order to prevent atelectasis were given before the termination of the hypnotic state. No narcotics were needed in the immediate postoperative period and only two hypodermic injections of phenergan, 25 mgm. were necessary. There were no postoperative complications, and recovery was uneventful. She was discharged from the hospital in 15 days. At the present time, two more patients who will have open-heart surgery in the near future are being conditioned.

There are many advantages to the use of hypnotic anesthesia. It can be terminated instantaneously. There is no depressing physiologic effect. It may be continued indefinitely after the operative procedure has been completed. Once hypnotic anesthesia has been obtained, it can be induced at any time. It is a pleasant experience without the nervous tension and apprehension usually associated with chemoanesthesia. There is no extra load on circulatory, respiratory, hepatic, and renal systems.

The disadvantages which may influence many physicians from attempting surgical procedures under hypnotic anesthesia should also be mentioned here. One can get over-enthusiastic on the subject of hypnosis and try to perform operations under hypnotic anesthesia to inflate one's own

ego. Many people cannot enter into a hypnotic state easily. There is an uncertainty in producing the necessary degree of hypnosis. The use of hypnosis without an adequate knowledge of general medical and analytical psychology can be dangerous. Hypnosis is time-consuming for the practicing physician, and adequately trained physicians are still few in number. Public resentment and prejudice still exists to the use of hypnosis, and proper education must be undertaken. Hull¹⁰ states that hypnotists must have the courage to brave the semisuperstitious fears of the general public and the uneasy suspicions of their orthodox scientific brethren.

The present renaissance of medical hypnosis is not fortuitous. It arises naturally out of the advancing knowledge of psychosomatic medicine and the increasing appreciation of the importance of psychologic factors in the maintenance of health. Increased interest will continue because of the number of physicians who are taking training in this field.⁹

SUMMARY

Hypnoanesthesia has been a controversial subject throughout the history of medicine. Chemical agents cause a respiratory depression which may have a harmful effect on the patient. Seven cases have been presented in which hypnoanesthesia was the only agent used. Indications for hypnotic anesthesia are listed. Hypnosis raises the threshold of pain and is the only means of anesthesia which carries no danger to the patient. It is a pleasant experience involving no tension or apprehension on the part of the patient. Advantages and disadvantages of hypnotic anesthesia are discussed.

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IATROGENIC ARTERIOVENOUS FISTULA: REPORT OF A CASE INVOLVING THE SUPERIOR MESENTERIC VESSELS*

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Arteriovenous fistula is a rare complication of medical procedures. Renewed awareness of the production of arteriovenous fistula by diagnostic and surgical maneuvers seems timely. The literature records numerous examples of iatrogenic fistulas in almost equally numerous anatomic areas. To date, reports of this lesion have appeared 46 times in the English literature. The precise cause of the complication in these cases is not always discussed, although often it was implied that the surgical or diagnostic procedure was responsible. A previously unreported fistula between the superior mesenteric artery and vein is documented by the following case.

CASE REPORT

R. C., a 35-year-old white woman, was first admitted to the Wesley Hospital, Oklahoma City, Oklahoma, in October, 1953 with complaints of recurrent abdominal cramps and diarrhea. Loss of weight began in 1947, following delivery of a premature infant (normal weight had been 120 pounds). A second premature child was born in 1950, at which time her weight was 94 pounds. An episode of intestinal obstruction in 1952 required resection of 45 cm. of the terminal small bowel. The pathologic diagnosis was regional ileitis. Her diet consisted mainly of jello and tomato juice, since other foods had gradually been eliminated as possible causes of diarrhea. Furthermore, she had developed recent nausea and peripheral edema. Finally, Papanicolaou smears were done periodically because she had had menorrhagia for the last 3 years.

Physical examination disclosed an emaciated, chronically ill white woman, appearing older than her stated age. Her weight was 82 pounds, temperature was 98°F., pulse 88 and blood pressure 98/60. The heart was not enlarged and there were

no murmurs. There was clubbing of all digits. The abdomen was distended and with visible peristalsis. A 3-inch, well healed paramedian scar was located in the right lower quadrant. The lower abdomen was tender on deep palpation. No organs or masses were noted, but a strong thrill was felt in the right lower abdomen. The whole abdomen was tympanitic and hyperresonant. On auscultation, the bowel sounds were hyperactive with rushes. A Grade IV continuous murmur accentuated in systole was heard near the umbilicus. X-ray of the intestinal tract revealed an anastomosis of the distal ileum to the midportion of the ascending colon (fig. 1). A definite irregularity and narrowing of the terminal ileum suggested regional ileitis. Moreover, there was a hypochromic anemia. All other laboratory studies were normal. The patient was discharged on a diet aimed at improving her nutrition.

One month later she was admitted for study of a suspected arteriovenous fistula. An aortogram demonstrated almost immediate filling of the portal system at the level of the 3rd lumbar intervertebral space (fig. 2). A dilated vessel seen to the right of the aorta was believed to represent a fistulous communication between a branch of the superior mesenteric artery and vein; both vessels appeared dilated. Chest x-ray was reported normal. Because of a Grade IV Papanicolaou smear, a dilatation and curettage and cervical biopsy were performed in January, 1959. A diagnosis of carcinoma *in situ* was made. However, the gynecologist agreed that treatment of the regional ileitis and arteriovenous fistula should have priority. Therefore, after further nutritional improvement and preparation with steroids, a laparotomy was performed in February, 1959. Through a midline incision, an arteriovenous fistula was easily demonstrated which appeared to involve the superior mesenteric artery, about 2.5 cm. distal to the middle colic branch (fig. 3). Control of the superior mesenteric artery and vein was obtained proximal to the fistula. The lesion was carefully exposed and appeared to be a discrete, soft, saccular mass approximately 3 cm. in diameter. Veins emanating from the mass were seen to distend with each arterial pulsation. A continuous thrill was palpable over the mass.

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Presented before the 28th Annual Assembly of the Southeastern Surgical Assembly of the Southeastern Surgical Congress, New Orleans, Louisiana, March 21 to 24, 1960.

There were two proximal veins, thickened and enlarged approximately four times. The proximal artery was twice normal size. The arteries distal to the aneurysm were smaller and the veins were enlarged. These latter vessels supplied the dis-

eased segment of bowel. The previous bowel resection had removed the terminal ileum and cecum. The distal ileum was enlarged and had a granulomatous appearance. Of the terminal ileum



FIG. 1. Small bowel series. An end-to-end anastomosis of the distal ileum to the lateral portion of the ascending colon is evident. Definite irregularity and narrowing of the terminal ileum is suggestive of regional ileitis. The proximal ileum is dilated.

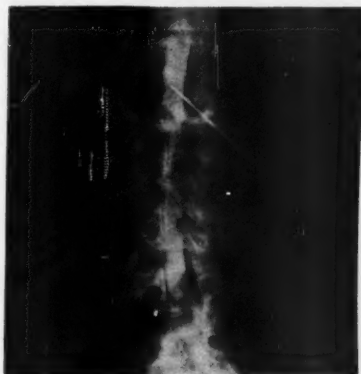


FIG. 2. Abdominal aortogram. The tip of the needle is inserted into the upper abdominal aorta at the level of the interspace between T-12 and L-1. Films show the abdominal aorta and its branches completely outlined, and at the level of the 3rd interspace there is a dilated vessel which extends to the right of the aorta and is believed to represent a fistulous communication between the superior mesenteric artery and vein. Prompt filling of the portal system is apparent.

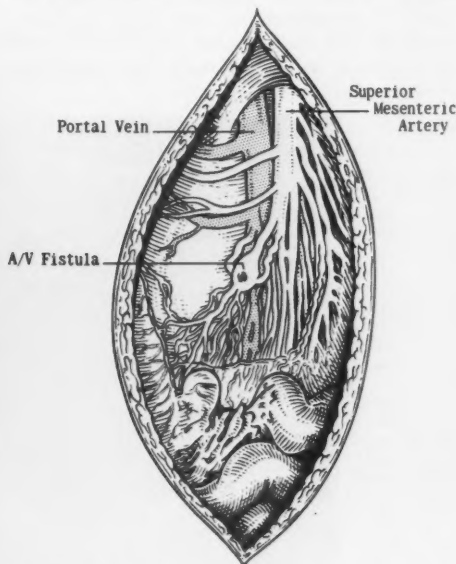


FIG. 3. Operative findings. Exposure is through a midline incision. Surgical mobilization and dissection of the branches of the superior mesenteric artery demonstrate a saccular mass just below the middle colic artery with a fistulous communication into associated veins which empty into the portal system. The bowel involved with regional ileitis is seen in the lower portion of the wound.



20 cm. were almost completely occluded. The proximal bowel was distended, but the colon was not remarkable. The involved bowel was resected with its mesentery which included the arteriovenous fistula. The proximal vessels were individually transfixed. An open ileocolic anastomosis was performed, and the abdomen was closed in a routine manner. Sixteen days later, the

patient was discharged with a regular diet, gaining weight, and having normal bowel movements.

The surgical specimen consisted of 67 cm. of terminal ileum and colon (fig. 4). The distal portion of the small bowel was thickened and the lumen compromised. The stenotic area measured approximately 12 cm. in length. The mucosa in this portion of the bowel revealed numerous

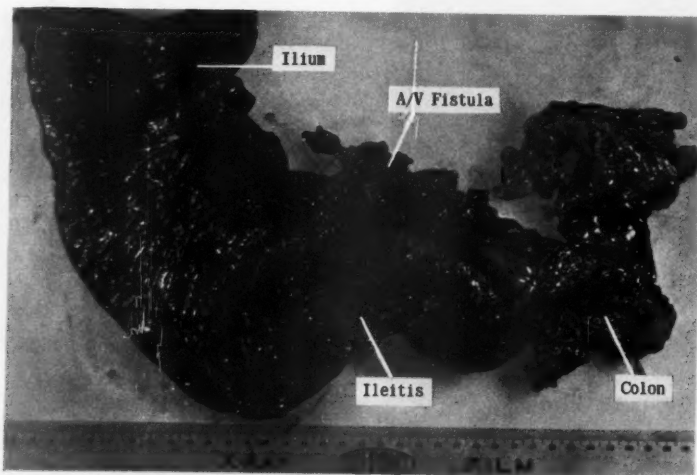


FIG. 4. Pathologic specimen consists of the resected bowel and arteriovenous fistula in the mesentery of the bowel. Hypertrophied, dilated ileum is seen to the left, and the granulomatous, thickened, ulcerated portion of the ileum is in the middle of the specimen. There is a short segment of essentially normal colon and omentum to the right.

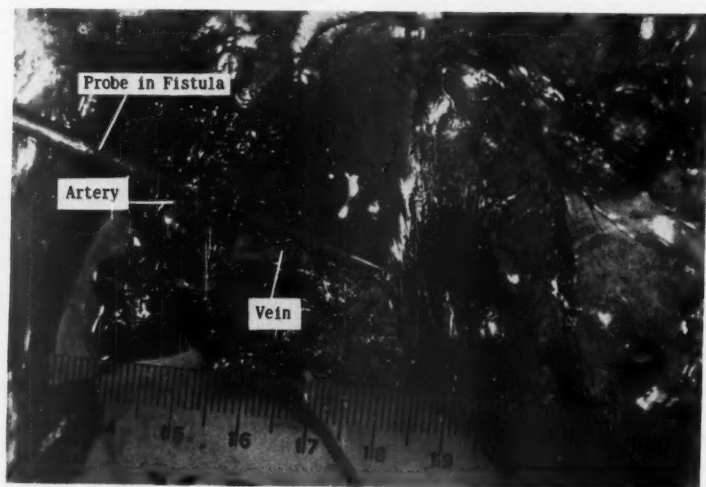


FIG. 5. Arteriovenous fistula. The diseased ileum extends across the top of the illustration. The superior mesenteric artery entering the fistula is shown. A metal probe is through the fistula and a proximal mesenteric vein is noted.

ulcerated areas of pseudopolyps approximately $\frac{1}{2}$ cm. in diameter. Adjacent to this area of bowel was an area of mucosal hyperemia and what grossly appeared to be a hyperplastic mucosa. This was approximately 10 cm. in length. The

remainder of the small bowel was normal except for dilatation and hypertrophy of the muscular wall. The colon was essentially normal. The mesentery contained an arteriovenous fistula approximately 7 cm. from the bowel wall (fig. 5).

TABLE 1
Resumé of iatrogenic arteriovenous fistula

Author	Reference	Date	Location	Etiology	Treatment	Result
Hunter	23	1757	Brachial	Bloodletting	None	Not reported
Hunter	24	1762	Brachial	Bloodletting	None	Not reported
Moore	38	1857	Temporal	Bloodletting	Proximal ligation	Good
Skiffassowski	38	1869	Temporal	Bloodletting	Ligature artery, ligature carotid and injection FeCl	Finally good
Burns	38	1899	Temporal	Bloodletting	Excision and pack	Good
Winlow-Edwards	38	1935	Temporal	Bloodletting	None	Not reported
Busche	38	1935	Temporal	Bloodletting	None	Not reported
Elkins	9	1948	Facial	Procaine injection	Excision	Good
Greeley-Throndson	18	1944	Facial	Roger Anderson splint	Excision	Good
Downs	7	1914	Superior thyroid	Thyroidectomy	Excision	Good
Mora	27	1929	Superior thyroid	Thyroidectomy	Excision	Good
Selman-Freedlander	35	1932	Superior thyroid	Thyroidectomy	Excision	Good
Ranshoff	32	1935	Superior thyroid	Thyroidectomy	Excision	Good
Robb-Eastcott	33	1954	Superior thyroid	Thyroidectomy	Excision?	Not reported
French <i>et al.</i>	13	1959	Superior thyroid	Thyroidectomy	Excision	Good
Reid-McGuire (Elkin)	10, 31	1949	Phrenic	Thoracentesis	Excision	Good
Glenn-Steinberg	17	1957	Internal mammary	Mastectomy	Excision	Good
Buchholz	3	1959	Splenic	Splenectomy	Excision	Good
Authors		1960	Superior mesenteric	Bowel resection	Excision	Good
Hollingsworth	21	1944	Renal	Nephrectomy	None	Not reported
Elkin	9	1948	Renal	Nephrectomy	Excision	Good
Schwartz <i>et al.</i>	34	1955	Renal	Nephrectomy	Excision	Good
Muller-Goodman	28	1956	Renal	Nephrectomy	Artery ligated	Died
Vast	37	1954	Renal	Nephrolithotomy	Nephrectomy	Good
DeBaakey <i>et al.</i>	1	1958	Aorta/inferior vena cava	Disc operation	Aortorrhaphy	Good
DeBaakey <i>et al.</i>	1	1958	Aorta/inferior vena cava	Disc operation	Vessel graft	Good
Harbison	20	1954	Common iliac/inferior vena cava	Disc operation	Aortorrhaphy	Good
Glass-Ilgensfritz	15	1954	Common iliac/inferior vena cava	Disc operation	Quad. ligation and excision	Good
Cooper cit. Harbison	20	1954	Common iliac/inferior vena cava	Disc operation	Sympathectomy and artery ligation	Fair
VonKoenel cit. Harbison	20	1954	Iliac	Disc operation	Attempt repair	Died
Rasmussen cit. Harbison	20	1954	Iliac	Disc operation	Sympathectomy and ligation	Fair
Linton-White	25	1945	Iliac	Disc operation	Sympathectomy and ligation	Good
Holcher	22	1948	Iliac	Disc operation	Quad. ligation	Fair
Grimson	19	1958	Iliac	Disc operation	Vessel graft	Good
Elkin-Banner	8	1946	Uterine	Hysterectomy	Excision	Good
Camp	4	1953	Ovarian	Hysterectomy	Excision	Good
Stuart	36	1929	Femoral	Amputation	Excision	Good
Brooks	2	1948	Femoral	Amputation	Excision	Good
Naylor	29	1950	Femoral	Amputation	Excision	Good
Fontaine	12	1948	Femoral	Arteriography	Not reported	Not reported
Robb-Eastcott	33	1954	Femoral	Hip arthrodesis	Excision and restoration	Good
Elkin	9	1948	Genicular	Meniscectomy	None	Not reported
Gamm	14	1942	Anterior tibial	Steinman pin	Arteriorrhaphy	Good
Mason <i>et al.</i>	26	1936	Posterior tibial	Amputation	Excision	Good
Elkin	9	1948	Posterior tibial	Steinman pin	None	Not reported
Glasser-Bray	16	1949	Posterior tibial	Arthrodesis	Excision	Good
Robb-Eastcott	33	1954	Posterior tibial	Fibulectomy	Excision	Good

The fistulous tract had a diameter of 7 mm. The microscopic impression was acute and chronic regional ileitis with ulceration and pseudopolyps. An arteriovenous fistula of the mesenteric vessels was included with the specimen.

In April of 1959, a hysterectomy was performed followed by an uneventful recovery. The patient had already gained 25 pounds and was having only one to three bowel movements daily. One year later her health was excellent.

DISCUSSION

Iatrogenic injuries of blood vessels have been recorded since the beginning of medical history. Galen in the first century described aneurysms produced in the course of bloodletting.³⁰ In 1757 and 1762, William Hunter reported arteriovenous fistulization which resulted from a lancet puncturing the basilic vein too deeply, with injury of the underlying brachial or radial artery.^{23, 24} A resumé of iatrogenic arteriovenous fistula is presented in table 1, which reviews the English literature and indicates, including the current case, 47 instances of iatrogenic fistulas. Many types of operative procedures have resulted in arteriovenous fistula (table 2). The simplest cause is bloodletting. Other less involved procedures that have produced fistulas are procaine injection,⁹ thoracentesis,^{10, 31} the insertion of Steinman pins,^{9, 14} and arteriography.¹² More technically complicated procedures, such as thyroidec-

tomy,^{7, 13, 26, 32, 33, 35} nephrectomy,^{9, 21, 28, 31} and excision of herniated intervertebral discs,^{1, 15, 19, 20, 22, 25} have had their share of this complication. The large number of arteriovenous fistulas resulting from disc surgery was surprising. Apparently puncture of the anterior spinal ligament occurs when the biting instrument pierces too deeply and bites out a section of aorta and inferior vena cava or a section of iliac artery and vein and thus produces fistulization.

No reports of arteriovenous fistula of the superior mesenteric artery and vein associated with an operative procedure have been reported. The current case certainly was associated with the earlier bowel resection. Often a transfixion ligature can be found in proximity to the fistula, thus accounting for this lesion.¹³ However, in this instance no ligature was found; consequently, it can be assumed that a suture ligature of catgut was used and absorbed. It was fortunate that the segment of ileum involved with regional ileitis was supplied by vessels emanating from the fistulous vascular tree. This readily allowed resection of the fistula and diseased bowel.

Many causes of regional ileitis have been suggested.⁵ In recent years the cortisones have been used extensively in the treatment of this problem.⁶ In some cases, an unusual vascular pattern in the mesentery of the involved intestine has been described.¹¹ If tissue congestion has any role in the production of ileitis, this concept might be strengthened by this case. The only area of diseased bowel was supplied by the vessels from the aneurysm with the resultant hyperemia of this portion of bowel. To the best of our knowledge this hypothesis has never been investigated.

Various factors are to blame for the production of arteriovenous fistulas during surgical procedures. It has been repeatedly emphasized that the use of individual ligation or transfixion of vessels abolishes the use of mass ligatures or transfixions which are the primary offenders.⁸⁻¹⁰ The anatomic proximity of arteries and veins makes it easy to pierce both these structures and cause a fistulous communication. When using pins for traction, the possibility of piercing vascular structures is ever present. The occurrence of fistulas secondary to needling has been rare, but it has followed thoracentesis and femoral arteriography. Thus, all cases naturally have as a basic etiology a penetrating object which establishes a communication between an artery and a vein.

During the last few years there has been an in-

TABLE 2

Etiology of iatrogenic arteriovenous fistula

Surgical Procedure	Number of Cases
Orthopedic	
Disc surgery	10
Arthrodesis	2
Orthopedic pins	2
Others	3
General surgery	
Thyroidectomy	6
Amputation	4
Others	3
Gynecology	
Hysterectomy	2
Urology	
Nephrectomy	4
Nephrolithotomy	1
Diagnostic studies	3
Bloodletting	7
Total	47

crease in diagnostic and therapeutic needling. The number of arteriovenous fistulas may increase as this trend continues. For example, puncture of intercostal, coronary, or other major vessels of the mediastinum during left heart catheterization could cause fistulization at these sites. Needle biopsies of many tissues, particularly the lung, pleura, liver, spleen, and kidney, are commonly done and no fistula from these maneuvers has been reported to date. However, this serious complication should be kept in mind when performing these diagnostic maneuvers.

SUMMARY

1. Iatrogenic arteriovenous fistula is a rare but important complication of surgical and diagnostic maneuvers.

2. The English literature contains 46 cases of arteriovenous fistulas of iatrogenic origin.

3. A previously unreported entity, arteriovenous fistula of the superior mesenteric vessels, is reported. Surgical excision of the fistula and the diseased bowel which was involved with regional ileitis was performed with a complete cure.

4. Careful individual vessel ligation and strict attention to anatomy during diagnostic needling and surgical procedures is recommended for the prevention of this lesion.

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GEORGIA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Thursday, March 2, 6 P.M.

President's Reception honoring guest speakers.

Friday, March 3, Morning

OPHTHALMOLOGY

1. Management of Complications of Cataract Surgery—Dr. Dwight Townes, *Louisville*
2. Tumors of the Eye and Adnexa in Children—Dr. Charles Iliff, *Baltimore*
3. The Management of Intraocular Malignancy—Dr. Edward Dunphy, *Boston*

Friday, March 3, Afternoon

OTOLARYNGOLOGY

4. Pediatric Otolaryngology—Dr. F. W. Davison, *Danville, Pa.*
 - A) Treatment of Sinusitis
 - B) Management of Acute Laryngeal Obstruction
5. Neurological Lesions in Otolaryngology—Dr. Lawrence Boies, *Minneapolis*
6. Diagnosis and Treatment of Deafness, including Otosclerosis—Dr. Theodore E. Walsh, *St. Louis*

Saturday, March 4, Morning

7. Surgery of Chronic Otitis—Dr. Theodore Walsh
8. Tinnitus and Vertigo—Dr. Lawrence Boies
9. Indications for Sinus Surgery, with Case Reports—Dr. F. W. Davison
10. Interesting External Ocular Lesions—Dr. Edward Dunphy
11. Tumors of the Eye and Adnexa in Adults—Dr. Charles Iliff
12. Significance of Hyaloid Changes following Cataract Surgery—Dr. Dwight Townes

1:00 P.M., Adjournment

Each presentation will be followed by questions from the floor and discussion. Round table luncheons are also planned.

SURGICAL TREATMENT OF HYPERTENSION RESULTING FROM RENAL ARTERY STENOSIS

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Houston, Texas

More than 10 years ago, a period ended during which nephrectomy was employed in treating hypertension caused by unilateral renovascular lesions. Experience with nephrectomy for unilateral renal disease was disappointing, since less than 20 per cent of cases found relief from hypertension.¹¹ Recent years have provided more sophisticated techniques both in diagnosis and technical means of definitive treatment for renovascular lesions producing hypertension. Therefore, lively surgical interest in this form of hypertension has developed again at an accelerated pace during the past several years.^{3, 5-9, 14} In the modern surgical approach, the kidney is preserved by direct revascularization procedures. Importance of renal conservation in patients with bilateral renal artery stenosis appears obvious, but in unilateral involvement it may be equally important, since it has been shown both experimentally and clinically that the stenotic process tends to protect the involved kidney from hypertensive nephrosclerosis.^{1, 6, 10, 12} In our own experience, renal function following revascularization for unilateral involvement is always superior on the side of renal artery narrowing. Surgical experience with 40 hypertensive patients treated by unilateral or bilateral revascularization procedures constitutes the basis of this report.

DIAGNOSIS

In general we have found no distinctive features in history or physical examination to delineate renovascular hypertension from essential hypertension. Age in our operative series ranged

from 30-72 years. Onset of hypertension was usually insidious and of at least several years' duration in most patients. Physical findings were fundamentally similar to those found in essential hypertension. Murmurs audible over the abdomen and flanks were not uncommon, but in most instances appeared to arise from associated arteriosclerotic involvement of aorta and iliac arteries rather than from stenosis in a renal artery.

Excretory pyelography represents the most readily available form of special study. With careful scrutiny, particularly of the 3- and 5-min. films, we have noted at least some slight aberration in about 40 per cent of our cases (fig. 1). Alterations which may suggest the presence of a renovascular lesion are disproportion in renal size and delay in excretion. The excretory pyelogram, however, will not establish the diagnosis nor can it be used as a screening test to exclude the possibility of renovascular lesions in hypertensive patients.

Another ordinarily available special procedure which may be useful in the diagnostic armamentarium for hypertension is the split or differential renal function test. Physiologic basis for this procedure as initially described by Howard and his associates is the reduced excretion of water from a kidney with renal artery narrowing as well as inability of such a kidney to concentrate sodium.⁴ General application of this procedure as a screening test is somewhat cumbersome since ureteral catheterization is necessary. Furthermore, this test is difficult to evaluate in bilateral lesions and does not differentiate certain parenchymal renal derangements. For these reasons, and because 40 per cent of our patients have had bilateral renal artery stenosis, the procedure has been employed for the most part as an adjunctive study useful primarily to confirm questionable lesions seen on renal arteriography. Differential discrete renal function studies have usually shown a depression in glomerular filtration in

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proportion to the degree of renal artery stenosis. Renal plasma flow is frequently within normal limits and, at most, only moderately reduced even with extreme narrowing of the renal artery.

As a screening procedure for hypertensive patients the most promising special study appears to be the renogram.¹³ This procedure is not objectionable to the patient, as it requires only intravenous injection of radioactive Diodrast followed by 15 min. of bilateral flank scanning. With increasing experience in interpreting tracings obtained in this manner from patients with renovascular lesions, more and more reliance has been placed on the procedure as a screening study (fig. 2).

Renal arteriography, however, constitutes the

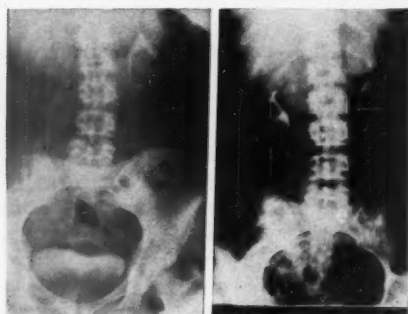


FIG. 1. Excretory pyelograms in hypertensive patient with stenosis of right renal artery. Before operation on left almost no function can be seen in right kidney on 5-min. film. Following revascularization with aorta to renal artery bypass graft, prompt excretion of contrast material is seen in roentgenogram on right.

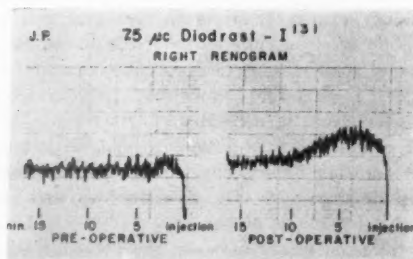


FIG. 2. Renograms in hypertensive patient with stenosis of right renal artery before and after patch graft reconstruction. Tracing before operation on left reflects reduced blood flow, together with impaired glomerular and tubular function. Following operation, renogram on right has normal contour.

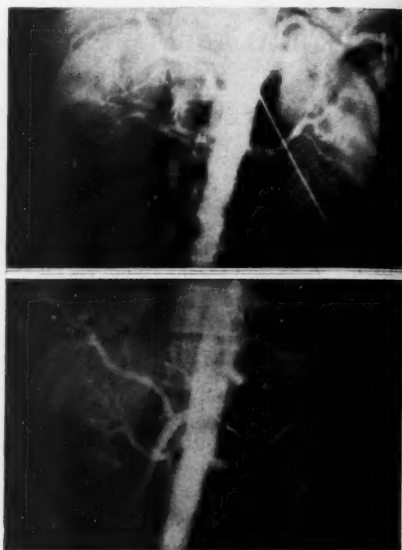


FIG. 3. Aortogram above shows no evidence of renal artery occlusive disease. Origin of inferior of two right renal arteries is concealed by aorta. Second study, below, with left oblique position shows stenosis of this renal artery arising anteriorly from aorta.

only available diagnostic procedure for making definitive and anatomical diagnosis. The technique that we have found most satisfactory for this purpose utilizes the translumbar injection of 25 cc. of 70 per cent Urokon high in the upper abdominal aorta. Radiographic technique must be of high quality to give sharp visualization of the renal arteries. Even with the best contrast visualization technics, some lesions in the renal artery may be missed, particularly orificial stenosis at the junction of the aorta and renal artery, since the aorta may overlies and conceal such stenosis (fig. 3). Clear delineation not only of the renal arteries and their primary branches but of the aorta as well is necessary for proper planning of the operative procedure.

SURGICAL MANAGEMENT

Preparation of the patient before operation differs only slightly from other major transabdominal vascular procedures. Through experience we have found that these patients tolerate anesthesia and operation better if allowed a normal diet for several days to reconstitute any sodium depletion from previous medical management.



FIG. 4. Operative photographs in hypertensive patient with combined right renal artery stenosis and abdominal aortic aneurysm. To left, post stenotic dilation can be seen in renal artery exposed by retracting left renal vein. To right is completed graft replacement of aortic bifurcation with right renal artery bypass.



FIG. 5. Aortogram on left following operation shows functioning bifurcation graft replacing aneurysm of aorta with bypass extension to right renal artery. Drawing on right shows operative procedure. Note proximity of renal bypass graft to aorta when renal artery is exposed from below by retracting left renal vein and vena cava.

Antihypertensive medication is also discontinued at least several days prior to operation, a measure which seems to facilitate anesthetic management.

Midline incision from xyphoid to pubis has been employed in all 40 cases. Subsequent approaches for retroperitoneal exposure depend on the location of renal artery stenosis and the technique of revascularization to be utilized. Three basic techniques have been employed by others; namely, renal artery endarterectomy, resection and graft replacement, and splenorenal arterial anastomosis. Each of these techniques has certain disadvantages and limitations. Better adapted for

revascularization are two other principles of arterial reconstruction; namely, bypass with a graft, and direct renal artery reconstruction with a patch of suitable graft material such as dacron. We have employed the graft bypass techniques in most instances because this method of revascularization offers a number of unique advantages. For one thing, renal artery continuity is not disrupted. For another, the period of renal artery occlusion can be limited to less than 15 min. Other advantages of the bypass principle are ability to use a large primary branch of the renal artery for graft attachment when necessary, and adaptability in treating bilateral lesions and lesions combined with aorto-iliac aneurysm or occlusive disease. Aortic exposure is provided through an incision in the posterior peritoneum and the graft is attached obliquely to the side of the terminal aorta. In some instances satisfactory exposure of the renal artery beyond the stenosis may be obtained through this same approach by lifting the left renal vein (figs. 4 and 5). Generally,

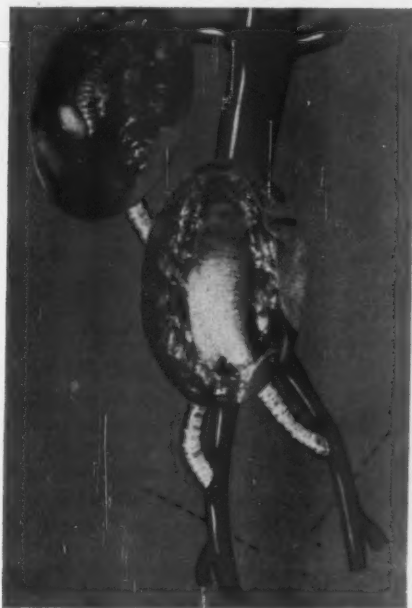


FIG. 6. Operative photographs and drawing showing bypass graft from aorta to both external iliac arteries and right renal artery for combined aorta-iliac occlusive disease and right renal artery stenosis. Right renal artery exposed through incision in peritoneal gutter, and graft tunneled up from attachment below with aorto-iliac bypass.

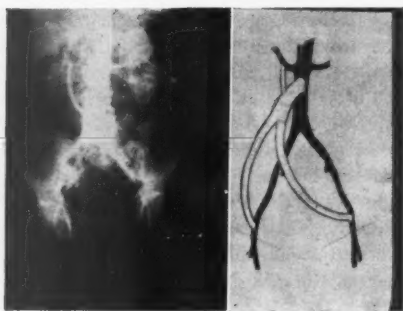


FIG. 7. Aortogram on left shows functioning bypass graft from aorta to both external iliac arteries and right renal artery. Drawing on right shows bypass principle used in this hypertensive patient.

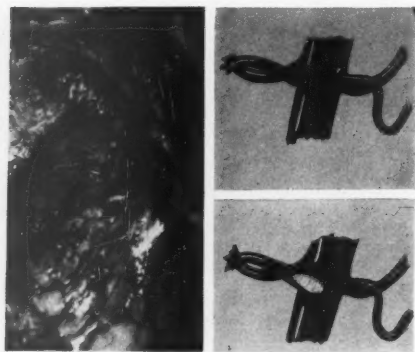


FIG. 8. Operative photograph at left shows completed patch graft reconstruction of renal artery with official stenosis. Drawings at right show technique of patch graft reconstruction.

more satisfactory exposure of the renal artery is obtained laterally through an incision in the peritoneal gutter with blunt dissection down to the renal artery. The graft is then tunneled up a short distance for end-to-side attachment with the renal artery (figs. 6 and 7). Knitted dacron tubes 8 mm. in diameter seem most desirable for renal bypass grafts.² When the aorto-iliac region is replaced or bypassed for concomitant aneurysm or occlusive disease, the renal bypass graft is attached proximally to this larger graft.

Certain cases of renovascular hypertension with well localized renal artery stenosis have appeared well suited for direct arterial reconstruction with a patch graft (fig. 8). This technique employs linear arteriotomy across the area of

stenosis, and reconstruction with an elliptically cut patch of dacron graft material. Such a procedure produces an area of arterial widening in place of stenosis. Endarterectomy may be combined with patch graft reconstruction.

RESULTS AND DISCUSSION

The gratifying reduction in arterial blood pressure following revascularization in this series of 40 patients firmly establishes such an approach in the treatment of renovascular hypertension. Eighty-two per cent of these patients became normotensive after operation and have remained so for periods up to 3 years. In the seven patients who failed to obtain complete relief of hypertension, four had some amelioration of the hypertensive process. Reasons for failure of response in these seven cases are, for one thing, severe nephrosclerotic changes in the contralateral kidney in unilateral renal artery stenosis. For another thing, some of these patients were in the sixth and seventh decades of life and had persistent, but mild, systolic hypertension associated with generalized arteriosclerosis. Two patients following unilateral revascularization were shown to have minimal contralateral renal artery stenosis on arteriographic study after operation. One death occurred in the series as the direct consequence of coronary occlusion.

Long term results of renal revascularization are not yet available, but on the basis of experience in arterial reconstructive procedures in the extremities, certain prognostications are justified. Two factors portend excellent long term function of these renal artery reconstructive procedures. First, rate of blood flow is comparatively high, usually ranging from 400–500 ml. per min. to each kidney. Second, the grafts are comparatively short and are not subjected to mechanical stresses such as bending and twisting, as occur in the extremities.

SUMMARY

This report was based on a surgical experience from 40 hypertensive patients with narrowing of one or both renal arteries treated by renal revascularization procedures.

Aorta to renal artery bypass graft was the most frequently employed technique in revascularization. Direct plastic reconstruction of the narrowed segment of the renal artery with a patch graft was performed in selected cases.

Eighty-two per cent of these patients developed normal blood pressure. Four of the seven patients failing to achieve normal arterial pressure demonstrated some improvement.

Bilateral renal artery stenosis was present in 40 per cent of the patients.

Significant improvement in renal function followed revascularization. In unilateral stenosis the revascularized kidney was always superior in function to the contralateral kidney.

Hypertension without obvious etiology warrants renal arteriography which is the only method to establish the definitive diagnosis of renovascular hypertension.

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PETER BRYCE

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The subject of this paper was one of the first alienists to recognize the principle of non-restraint as an aid in the treatment of insanity.

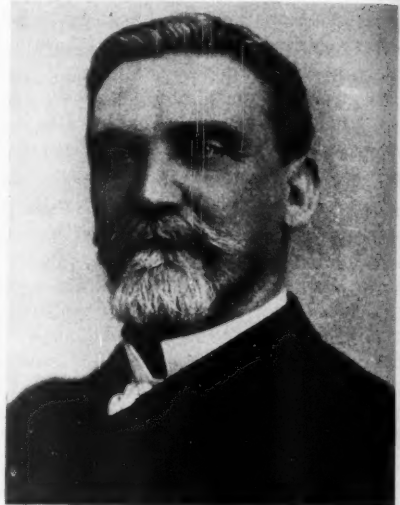
Peter Bryce was born in Columbia, South Carolina, on March 5, 1834. He was of Scotch ancestry. His father, who came to America as a young boy, became a successful business man and enjoyed ample means for giving his children all the advantages of a liberal education. Peter was described as possessing from his earliest youth a quick and sprightly mind, with genial manners that always won easy access to the hearts of friends and acquaintances.

Peter was admitted to the famous South Carolina Military Academy, The Citadel, on January 1, 1852. Four years later, November, 1855, he graduated with honors and immediately became an officer in a bank at Columbia, South Carolina. He was given a flattering offer by a prominent financial institution, but he declined as he had already decided upon medicine as his profession. Young Bryce had been selected as one of the speakers at the commencement exercises and the comments about his address in the local paper seem to point up or portend the many fine qualities that came to fruition during his long years of service to Alabama: "*Natural Ethics* by P. Bryce of Columbia was handled with much ability for so young a speaker. He gave evidence of a fine order of intellect, an aptness to analyze and discuss the more difficult and abstruse sciences. His manner and style would indicate a talent to excel in popular oratory".

In 1857, Peter Bryce entered the study of medicine in the Medical Department of the University of New York, from which he received the degree of Doctor of Medicine in March, 1859. Soon after graduation, he went abroad to study and to visit hospitals in Europe and especially those in Paris. On his return from Europe, having previously determined to make a specialty of nervous disorders, he became assistant physician at the Insane Hospital, New Jersey.

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Presented at a meeting of the Alabama Academy of Neurology and Psychiatry, May 28, 1959.



DR. PETER BRYCE

The minutes of the Board of Regents, S. C., State Hospital, Columbia, Saturday, October 1, 1859, state that Dr. Peter Bryce had been nominated for the position of the first assistant physician and had accepted. The annual report of the hospital superintendent, Dr. James W. Parker, November 5, 1859, contained the following statement: "Until recently, and for good reasons, the responsible office of assistant physician, provided for in the By-Laws, has never been filled. This office is now occupied by a party solicited, and not solicitous, to serve. The high testimonials of professional ability and moral character which Dr. Bryce brings from home and abroad are fully justified by the results of his labors and associations among us." In the next annual report by Dr. Parker, November 5, 1860, this statement appears: "In May, we lost the valuable services of Dr. Bryce. Justice to himself and with a view to extend his sphere of usefulness, he resigned his place at this Institution as assistant physician, and is now the superintendent and physician of the Alabama Hospital for the Insane."

About 1850, Dr. D. Fair and his partner, Dr.

A. G. Mabry, both eminent physicians of Selma, Alabama, brought before their local medical society the subject of a hospital for the insane. Dr. Mabry was corresponding secretary of the society and immediately entered into correspondence with other local Alabama medical societies and succeeded in securing a delegate from each of them to present the matter to the next legislature. Their commissioner met with encouragement, but not success. He was sent a second time and there met Miss Dorothea Lynde Dix of New York. Miss Dix was a philanthropist who had been actuated by a singular experience which had come into her life, to undertake the task of visiting all of our states in which there were no hospitals for the insane. A cherished friend of hers had become insane, and it had fallen to her lot to nurse that friend till death. Miss Dix had already visited Alabama and presented a memorandum on December 14, 1849, to the General Assembly of Alabama, with the end in view of establishing a hospital for the insane in the state. In the memorandum, she attacked the practice of confining the mentally ill in jails. When she learned of the first efforts of the commissioner, she returned to Alabama to aid him, even though the country was ringing with the heated politics growing out of the discussions of abolitionism. Miss Dix, in conjunction with the commissioner, went before the Governor and the state legislature and presented plans for the erection and equipment of a hospital for the insane of Alabama. The General Assembly of Alabama made provision to establish a state hospital for insane persons in Alabama in an act which was signed by Governor Henry W. Collier on February 6, 1852. The sum of \$250,000 was appropriated to erect the structure, and the laying of the cornerstone of the Alabama Asylum for the Insane on Thursday July 14, 1853 was a well planned event. It was attended by the Governor of Alabama, President Basil Manly of the University, trustees of the University, trustees of the hospital, representatives of various societies at the University, the Mayor of Tuscaloosa, and many other distinguished guests. The address was delivered by Landon C. Garland, who was professor of mathematics, natural philosophy and astronomy at the University of Alabama and who later became president of that institution. An excerpt from the editorial in *The Monitor*, Tuscaloosa, July 15, 1853, about the above ceremonies seems significant: "... an event was celebrated, the interest and importance of which will be felt

and appreciated by every philanthropist in our land." Miss Dix, in her self-appointed task, was following in the footsteps of John Howard (1726-1790), the renowned English philanthropist, prison-reformer, and inspector of hospitals and, as a result, one biographer referred to her as "the Howardess of her day."

Dr. A. Lopez of Mobile was commissioned to visit asylums in the northern states, and he secured from the Association of Medical Superintendents of American Hospitals for the Insane, the plans for the structure that was built at Tuscaloosa. However, the building was slow in construction, and the first patient was not admitted until April 5, 1861.

After the plans for building the Alabama Insane Hospital had crystallized and construction was actually progressing, Miss Dix urged Dr. Peter Bryce to apply for the position of physician of the proposed new insane hospital at Tuscaloosa. At that time, Dr. Bryce was assistant physician at the Lunatic Asylum, Columbia, South Carolina. Consequently, on December 30, 1859, Dr. Bryce wrote a letter to Dr. Mabry in which he made formal application for the office of physician to the Alabama Insane Hospital. In the letter, Dr. Bryce stated that he was making the application at the earnest instigation of Miss Dix and Dr. James W. Parker, Superintendent of the Lunatic Asylum, Columbia, South Carolina. For references he suggested letters from several individuals including Governor J. H. Means of South Carolina and two of his medical school teachers, Dr. Gunning S. Bedford and Dr. John T. Metacalfe. No doubt the latter was included since Dr. Bryce had won the Metacalfe Prize in his last year of medicine. The application was acted upon by the first Board of Trustees of the Alabama Insane Hospital, and Dr. Bryce was appointed to the position of Medical Superintendent of the institution. The board included an able group of distinguished people: Basil Manly, President of the University of Alabama, Dr. Reuben Searcy, and Dr. James Guild. The latter two were Tuscaloosa physicians. Thus, at the age of 26, Dr. Bryce became the first superintendent of the hospital on July 1, 1860.

Dr. Bryce became known for his theories and practice concerning the abolition of mechanical and other restraints in the treatment of the insane patient. The system of non-restraint had been suggested by Connolly of Great Britain, but Bryce put the theories into practice and stopped

the use of the strait-jacket system of restraint. The abolition of mechanical restraint did not require the administration of more quieting drugs, rougher handling, or longer seclusion of the patients. Every patient in the hospital had some employment which helped to keep him occupied and happy. The results convinced Dr. Bryce that it was the greatest advance in the treatment of the insane within the preceding 50 years.

Dr. Bryce held many positions of honor and trust in addition to being superintendent of one of the most respected hospitals for the insane in the United States, a position which attested to the high esteem in which he was held as a man, a physician, a scientist, and a scholar.

He took an active interest in the Medical Association of the State of Alabama and was rewarded by being elected second vice-president in 1871, and first vice-president in 1875. Then in 1877, he was elected president of the Association. The following statement about Dr. Bryce's presidential address which he delivered on April 9th appeared in *The Eufaula Times*, Eufaula, Alabama, April 11, 1878: "Dr. Bryce's address was remarkable for its breadth of thought, its liberal ideas and its great wealth of suggestion; it presents to the profession a field of glorious achievement and inspires the hope that many of the attendant evils of life may be finally removed. It was able, chaste, elegant, and altogether one of the most forcible and attractive discourses to which we ever listened." The title of Dr. Bryce's address was "President's Annual Message." Dr. Bryce served as a member of the State Board of Censors for many years. He was the orator of the Mobile meeting of the Alabama Association in 1882. He also was a member of the State Board of Health of Alabama. He was first vice-president of the Medico-Legal Society of New York, a society whose membership embraced some of the foremost scholars and alienists of America, England, and Europe. Dr. Bryce was a prominent member of the National Society of Charities and Correction. For many years, he was president of the Alabama Historical Society. About 5 years before his death, the General Assembly of Alabama established a lunacy commission which had the duty of helping with the trials of insane criminals, and he was president of the commission. He was a member of the Board of Trustees of the Medical College of Alabama, Mobile, from 1888 until his death.

On May 6, 1892, Dr. Bryce was elected president of the American Medical Psychological Association at the Washington, D. C. meeting. The Association is composed of the medical superintendents of American institutions for the insane. It had been the custom in electing officers to follow the rule of promotion, but in the election of Dr. Bryce the custom was disregarded. He was chosen because of his reputation in the treatment of insane patients, especially for his system of industrial management (making all patients who were able to do so engage in manual labor) and reduction of physical restraint of most of the patients. The election of Dr. Bryce was a high compliment to his many accomplishments at the Alabama Hospital for the Insane, and this is especially true since he was not present at the meeting because of illness.

He was summoned to Washington, D. C., in November 1881, as an expert to testify in the trial of Charles J. Guiteau who shot President James A. Garfield. However, he was not able to attend the trial because two of his assistants were absent from the hospital.

The Board of Trustees of the University of Alabama conferred the honorary degree, Doctor of Laws, upon Dr. Bryce at the Fifty-first Annual Commencement, June, 1882. The following statement appeared in an editorial in *The Clarion*, Tuscaloosa, concerning the action of the trustees: "And we but echo the sentiment of his friends throughout the country, when we say that the distinction has been most worthily and honorably won."

Dr. Bryce was an active member of the state temperance movement and in a letter to John T. Tanner, president of the State Temperance Convention, Montgomery, November 20, 1882, he stated: "It has been my privilege on several recent occasions to bring the question, in its sanitary aspects, before our State Medical Association, and I shall never feel that my work in that direction has been fully accomplished until this learned and enlightened body of medical men of Alabama has declared itself unequivocally in favor of prohibition."

He was invited to accept the Chair of Nervous and Mental Diseases in the Medical College of Alabama in Mobile. An editorial in *The Gazette*, Tuscaloosa, carried this statement: "It is to be regretted that Dr. Bryce, than whom no man in the South is more eminently qualified, may not

find it compatible with his duties to the hospital to undertake this important work at so great a distance as Mobile from the scene of his ever watchful care and solicitude. . . . And yet, we believe there is a way by which our medical students may reap some of the benefits of his scientific research and vast practical experience and observation of this wonderful subject." In spite of sentiment, Dr. Bryce wrote to the faculty that he would not be able to accept the position.

Since he was an able lecturer, he was invited to be the principal speaker at various commencement exercises. In 1885, two colleges for women invited him to address their graduating classes, and the subjects of the addresses are worthy of mention. The two institutions were the Tuscaloosa Female College and Marion Female Seminary. At the former, the subject of his lecture was "A Plea for the Higher Scientific Education for Women" and at the latter on June 3, his subject was "The Higher Education of Women."

Dr. Bryce wrote many papers in addition to his presidential address before the Alabama Medical Association, and some of them were quite profound. In July 1888, he read a paper on Moral and Criminal Responsibility, before the National Conference of Charities and Penal and Reformatory Institutions at its annual meeting in Buffalo, New York. This paper was widely read and favorably commented upon on both sides of the Atlantic. However, the one that probably aroused the most comment was the one which he reported to the Medico-Legal Society of New York and which appeared in the Medico-Legal Journal for 1890. This paper became the chief basis of a symposium, on the system of mechanical non-restraint, in which the leading alienists in England and America participated.

He was not only respected for his theories on the treatment of the insane, but he seemed to be a regular fellow. He was a member of the Gun Club of Tuscaloosa, and after a serious illness, the Gun Club sent a letter to the local editor, and a paragraph is quoted from that letter: "We are glad to note Dr. Bryce shoots with us again: he is not only one of the best quail shots in the state, but he has, also, led our club at inanimate targets for ten or twelve years." He also took an active interest in local civic and social affairs in Tuscaloosa. He was one of the

founders of the Tuscaloosa Club and served as its first president.

The Republican, St. Louis, April 9, 1884, used the following headline to an article about Dr. Bryce and the Alabama Insane Hospital: "An Asylum that has burned its strait-jackets and governs only by kindness."

The New York Herald, Monday, December 15, 1884, carried a long column about Dr. Bryce: "In 1882, with the concurrence of the trustees, Dr. Bryce abolished all mechanical restraints in managing the patients. . . . 'As to increases of suicides, homicides and accidents,' Dr. Bryce says, 'we have enjoyed perfect immunity from any of these predicted evils. The abolition of mechanical restraint did not require the administration of more quieting medicines, rougher handling or longer seclusion of the patients.'"

The Evening Post, Semi-Weekly, New York, November 26, 1886, carried this statement about Dr. Bryce: "In the care of the insane Alabama stands among the foremost states of the Union. Dr. P. Bryce, the Superintendent of the Insane Hospital, holds a high rank among alienists. Dr. Bryce was one of the earliest and strongest advocates of reform in the matter of mechanical restraint. Five years ago the old strait-jacket system was abolished in his institution. . . . With the exception of the occasional confinement to his room of a maniacal or excited patient, there has been no restraint of any kind upon the patients in the hospital and the excellent results of the experiment have convinced Dr. Bryce that no greater advance has been made in the treatment of the insane within the past fifty years than the abolition of mechanical and other unnecessary restraints."

Willis G. Clark, in his history of education in Alabama, in 1889 made the following comments concerning Dr. Bryce: "Dr. Bryce is a man of commanding appearance and attractive bearing. His features beam with good-humor and benevolence, and in his manners there is an irresistible magnetism. He is a graceful public speaker, as well as a forceful and fluent writer. He is accomplished socially as well as intellectually, and carries spirit, vivacity, and good fellowship with him into every social circle in which he moves."

The world is fortunate in having from Dr. Bryce's own pen a description of those qualities of head and heart which must be mingled in a man so as to make him fit to adorn the high office

of Hospital Superintendent, having the care and treatment of those unfortunate victims of disease whose lives are clouded by the shadows of confinement in an insane asylum. In the preface to the Rules and Regulations of the Alabama Insane Hospital, so excellently prepared by himself, he unwittingly mirrors his own characteristics, which his splendid administration of over 30 years nobly illustrated. That "... the hungry are to be fed, the naked to be clothed, strangers to be received and welcomed, and that those who are sick and in prison are to be visited," and that the "work has need of all the kindness and gentleness and unselfishness of which we are capable;" he adds: "The health, comfort and human custody of this unfortunate class of sufferers must therefore receive the first and highest consideration, alike of the trustees, officers, and employees of the institution. There can be no higher or nobler work than the care of these afflicted creatures, and no work which requires a more special fitness for its successful prosecution. In exactly what this fitness or peculiar adaptation consists, it would be difficult to define; but super-added to a large measure of general intelligence, professional skill, tact, industry, and general integrity, there are other traits of character which are absolutely indispensable to success. No one who is high-tempered, irritable, resentful, or faultfinding—no one who has not perfect control of his temper, and who is not endowed by nature with a kind, sympathetic heart and loving disposition, can ever hope to attain the highest usefulness in the treatment and care of the insane. Under the most favorable circumstances, the work will require the most constant self-denial and control; and no one should enter upon it who does not in a large degree possess these requisite qualifications." To this picture he subscribes, with appropriate embellishment, the golden rule of inspiration as the highest duty of the Superintendent to his patients. "The simplest of all rules," he concludes, "is also the best:—'Do as you wish to be done by.' Do to your associates, above and below you in authority, as you would wish them to do to you if your places were changed. Above all, do to every patient as you would yourself like to be done by if you were away from home and deprived of your freedom by loss of your reason."

Dr. Bryce married Miss Ellen Clarkson, Columbia, S. C., on November 28, 1860; she was a lineal descendant on her father's side of the

great Thomas Boston, and on her mother's side, of George Herriott, who built the celebrated George Herriott Hospital. Mrs. Bryce, although not in the employ of the hospital, was involved in various activities of the institution. The meetings of the Literary, Social and Musical Club which occurred once in two weeks on Saturday evenings, alternated with Mrs. Bryce's receptions or entertainments given the patients. Morning services were held regularly in the beautiful hospital chapel with Dr. Bryce in the pulpit to read the Bible and the prayers. Mrs. Bryce contributed to the music during the services. The singing class, which was composed of the inmates was directed by Mrs. Bryce, and the class learned the songs for the morning services and for the regular Sunday afternoon singing by all the patients in the hospital. Mrs. Bryce took an active part in the local young Women's Christian Temperance Union and was elected president of the Union in Alabama. She found time to conduct a Sunday school for the children of the employees of the hospital. In 1887, accompanied by Mrs. Bryce, Dr. Bryce enjoyed an extensive European tour, a vacation which their long years of devotion and service to the institution had justly earned.

Celebration of the silver wedding anniversary of Dr. and Mrs. Bryce, which was held on Saturday, November 28, 1885, was not an invitation affair but was attended by many of their Tuscaloosa friends. The interesting and brilliant reception ran throughout the day for the townspeople. The local correspondent stated that it was at the reception of the hospital patients in the evening that there were the most touching manifestations of good wishes and congratulations for Dr. and Mrs. Bryce. The patients were received by Dr. and Mrs. Bryce with the same gracious courtesy with which they had welcomed their friends from the city during the day. Mrs. Bryce who was one of the most charming and accomplished women of her day, was a real helpmate for Dr. Bryce.

Dr. Bryce was a man of commanding appearance and unbounded energy. His pleasant and social disposition won him many friends. Although he seemed always to be in a hurry, he had time for a pleasant smile and a kind word for everyone. He was a fruitful writer, a graceful speaker, and one of the most accomplished gentlemen in this country. He died of Bright's disease at 6:30 a.m., Sunday, August 14, 1892.

The funeral was held in Christ Church and the remains were interred on the lawn in front of the hospital building.

Following Dr. Bryce's death, Governor Thomas G. Jones, accompanied Dr. J. B. Gaston, ex-Mayor of Montgomery, to Tuscaloosa to preside over the meeting of the trustees of the Alabama Hospital to select a successor to Dr. Peter Bryce. Dr. James T. Searcy was chosen Superintendent of the Alabama Hospital for the Insane. Governor Thomas G. Jones suggested that the next legislature include the name of Dr. Bryce in the corporate title of the Insane Hospital. This was passed on February 8, 1893, and the new name adopted for the hospital was the Alabama Bryce Insane Hospital.

General R. Brinkerhoff of Mansfield, Ohio, for 25 years president of the Board of Charities of that state, at a conference on prison reform and public charities held in Louisville, Kentucky, made the following statement about Dr. Bryce and the Alabama Insane Hospital: "The best managed asylum I ever saw was in the South. It was located at Tuscaloosa, Alabama, and was called the Alabama State Hospital. Under the supervision of the late Dr. Bryce, then in charge, it was even at that time, 20 years ago, the most nearly ideal institution of its kind I have ever visited, and I have been in every one of any consequence in the United States. . . . All the clothes worn in the asylum were made by the patients. Every person in it had some employment. The utmost gentleness was employed toward the inmates. A system, by which the patients are classified and placed together accordingly, was employed. A general dining room was provided in which almost all of them ate to-

gether. The name of the institution has now been changed to the Bryce Hospital."

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12. OWEN, T. M.: *History of Alabama and Dictionary of Alabama Biography*, Vol. 3, pp. 244-245. S. J. Clarke Publishing Co., Chicago, 1921.
13. Private correspondence from individuals who are at schools where Dr. Bryce attended or hospitals where he was associated.
14. *The Monitor*, Tuscaloosa, Friday, July 15, 1853.
15. Transactions, Medical Association of the State of Alabama, 1869-1893.

Book Reviews

The editors of THE AMERICAN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.

Treatment of Cancer in Clinical Practice. By PETER B. KUNKLER, M. D., AND ANTHONY J. H. RAINS, M. D. The Williams & Wilkins Company, Baltimore, 1959.

With the increase in knowledge of the nature and treatment of cancer, there is a great need for monographs that summarize much of this information and make it available to physicians who are actively involved in the clinical management of cancer. The purpose of the editors of this book is to stress the importance of collaboration of various disciplines, such as surgery, radiotherapy and chemotherapy. The contributions, therefore, have been selected from several treating centers in Great Britain to present the views of different teams involved in the treatment of cancer.

The first chapters discuss the general principles of management. The remaining chapters discuss in detail specific methods of therapy for malignant neoplasms arising in different organs. The clinical features of the disease are discussed briefly and only with regard to their relation to treatment. This is unfortunate but unavoidable in a book of this size in which necessary surgical and radiotherapeutic techniques are discussed in detail. Although the contributors present their personal opinions, these are usually supported by references to comparable results obtained in other centers. In general, these opinions can be accepted with a minimum of disagreement as they represent the commonly accepted forms of treatment.

This book fills a great gap in the rapidly growing literature of cancer and should prove to be of particular value for residents training in various specialties such as surgery, radiology and gynecology. Its main contributions should be to acquaint various specialists with the work being done in other fields of cancer therapy and to stress teamwork in the management of the cancer patient.

RAUL MERCADO, JR., M. D.

Osteochondritis Dissecans. By I. F. SMILLIE, O.B.E., CH.M., F.R.C.S.(Ed.), F.R.F.P.S. The Williams & Wilkins Company, Baltimore.

The author presents the subject of osteochondritis dissecans in a thorough manner. His text is divided into two parts, the first of which concerns etiology and pathology. The general discussion of what is known of this condition is very worthwhile.

Care is taken to review different theories. Included are the knee, the metatarsophalangeal joints, the elbow, the ankle, and the hip joint. Differences are pointed out and comparisons made relative to these joints. Controversial features are pointed out when they arise.

Part One is summarized in a concise fashion, so much so that one might consider reviewing the summary before attempting to digest the material. If this is done, Part Two, which discusses the clinical features and treatment of each joint, will be much easier. Conservative treatment, operative and nonoperative, is discussed in detail, with unusually good photographs and drawings. Charting of cases follows the discussion of each joint, so that the reader may have the opportunity to review the cases that the author has accumulated in his vast experience. The result is a text worthy of review by all those within the field of orthopedic surgery. This is not a simple text to be taken lightly. As the author points out in the Preface, each part of the book must be read in its entirety to gain the impression that it is intended to convey. What is conveyed is as worthwhile a discussion on this fascinating lesion as is in print.

A. GIBSON PACKARD, JR., M.D.

Surgical Anatomy of the Bronchovascular Segments. W. E. BLOOMER, M.D., A. A. LIEBOW, M.D. AND M. R. HALES, M.D. Charles C Thomas, Publisher, Springfield, Ill., 1960.

This book is much more than another medical text; it is a work of art, devoted to the subject which is exactly defined by the title; it is also an eminently authoritative presentation of the subject.

As is quite generally known, the thoracic surgeons and the pathologists at Yale have been preparing beautiful casts of the tracheobronchial tree and pulmonary vasculature for many years. To produce this book, they have analysed their specimens in terms of the Jackson-Huber terminology (now adopted by the American Association for Thoracic Surgery and the American Broncho-Esophageal Association) as well as the numerical tabulation of Boyden.

The book follows a rigid outline. After a general description of the lungs, each of the five lobes is considered from three aspects: A discussion of the surgical anatomy is followed by a detailed discussion of the known variations of structure, and then by a thorough-going discussion of the various surgical approaches to the lobe or region. Each section is profusely supplemented with tables and a remarkable group of illustrations,

which consist of diagrams as well as photographs of the casts.

A typical illustration consists of three parts: A small photograph of a lung cast viewed from one particular aspect, such as the lateral; a specific area, such as the middle lobe region, shown in an enlargement and accompanied by a diagram; a separate colored drawing to emphasize one point or another. To complement these illustrations, a supplement, consisting of 168 stereo color slides, is available.

The final chapter on radiographic demonstration of bronchovascular anatomy is good, but the illustrations hardly compare with those in previous sections.

It should also be pointed out that the presentation throughout is strictly limited to the subject—the surgical anatomy of the bronchovascular segments—and does not consider microscopic or gross anatomy in the usual sense.

This book deserves a reviewer's general comment; this is: Medicine, especially the branch of thoracic surgery, is fortunate to have men who are both willing and able to labor through the tedium necessary to produce a volume such as this.

BRUCE W. ARMSTRONG, M.D.

The Treatment of Bronchial Neoplasms. THE JOHN ALEXANDER MONOGRAPH SERIES. Charles C Thomas, Publisher, Springfield, Ill., 1959.

This book, which is Number III in the John Alexander Monograph Series, expresses the personal philosophy of the authors toward the treatment of bronchial neoplasms, with special emphasis on bronchogenic carcinomas.

Beginning with the very plausible postulate that a rationale for therapy must be based on a general theory of the natural history of cancer, they outline two antithetic theories: the classical temporal theory and the more recent concept of biologic predeterminism as described by Ian McDonald (Surg., Gyn., and Obst. 92: 443, 1951 and 106: 227, 1958). The former is largely rejected and the latter largely accepted as the rational basis for therapy.

It is probably unfair to give their argument briefly, but, in essence, it can be excerpted from the conclusion of the first chapter:

Whereas early detection and treatment may prolong survival time in some patients, the temporal factor is of secondary importance to the biologic factors in the rationale of treatment of bronchogenic carcinoma. Application of the theory of biologic predeterminism to bronchogenic carcinoma explains the variegated pattern of behavior and prognosis in this neoplasm and places the rationale for treatment on

a logical basis. The cell type, location, and the resistance of the host largely determine the pattern of behavior and prognosis.

They continue later in the same summary:

The challenge is to learn enough about the biologic characteristics of the various types of bronchogenic carcinoma so that it will be known which lesions are suitable for surgery, which will be benefited by radical resections, which may be treated by more conservative resections with a better quality of survival, and which types will be harmed by injudicious application of surgical techniques, being better treated by means of irradiation or chemotherapeutic methods.

With these bases, the authors proceed to consider the selection of patients for surgery, selection of operation, irradiation therapy, chemotherapy, terminal care, results, and bronchial adenoma.

This book is almost certain to result in considerable controversy. It will be unfortunate if this is not so, because the authors have raised more questions than can be answered at present. In view of their desire to "... contribute to an improvement in the results of the surgical and nonsurgical treatment of this disease," the controversy and the questions will probably be welcomed.

BRUCE W. ARMSTRONG, M.D.

The Concise Encyclopedia of Modern Surgery. By JAMES HALE RUTLEDGE, M.D. Chilton Company, Book Division, Philadelphia.

The usual formality of including a preface or some preliminary statement that reflects the philosophy of the author as well as his purposes for writing, has been dispensed with by this author. The publisher, however, has incorporated the author's purposes with the publisher's purposes in a review which can be found on the flaps of the paper book cover.

According to this appended review, the book was written for use in "the teaching of all arts related to surgery." Some 27 seemingly diverse groups are expected to be able either to refer to this book or to use it as a standard textbook. Some of the groups mentioned include morticians, physicians, hospital administrators, student nurses, dentists, insurance claim adjusters, medical secretaries and physical therapists.

The author-illustrator, James H. Rutledge, is a physician in private surgical practice in Illinois. Dr. Rutledge also serves as a consultant surgeon for various hospitals.

This volume would be most accessible to interested readers if it were available in general public libraries. Prospective patients, for in-

stance, could find the first four chapters informative as to the selection of a doctor, the relationship of a surgeon to a patient, medical-legal implications, preparing to go to the hospital, helping with one's hospital care, acceptable visitor conduct, and common hospital procedures.

An attempt to use this book for the education and preparation of professional nurses would be inappropriate. Understandably, a 308-page encyclopedia could not attain the scientific depth essential for the nurse of today who is expected to care for patients who are being treated with increasingly complex therapeutic methods. Four pages are devoted to "Surgical Diseases of the Breast" (Chapter 24). Symptoms of breast cancer are described in relation to metastatic extension.

The psychophysiological preparation of an individual for the procedure of radical mastectomy is excluded, as is any reference to muscle exercise postoperatively.

In Chapter 3, Dr. Rutledge describes the main purpose of the nursing profession as the assistance of the doctor in the practice of medicine. Nursing licensure control acts cause the practice of medicine by nurses to be illegal. The primary duty of the nurse, the author states, is "to see that the doctor's orders are executed." In many of the larger and more modern medical centers, physicians prefer that professional nurses primarily care for patients and require them to exercise judgment and discretion in doing so.

CAROL M. HOSFELD, R. N.

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